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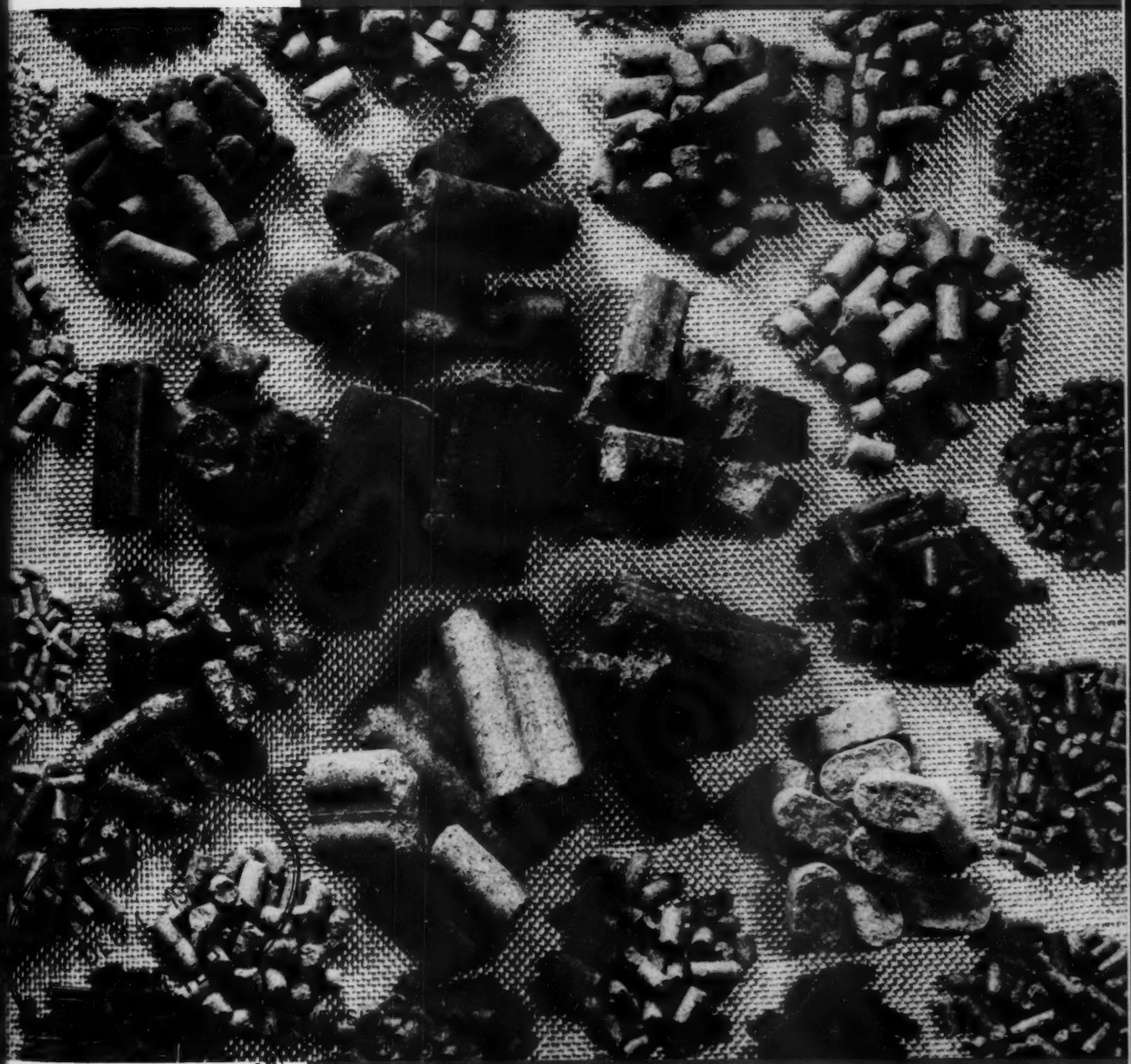

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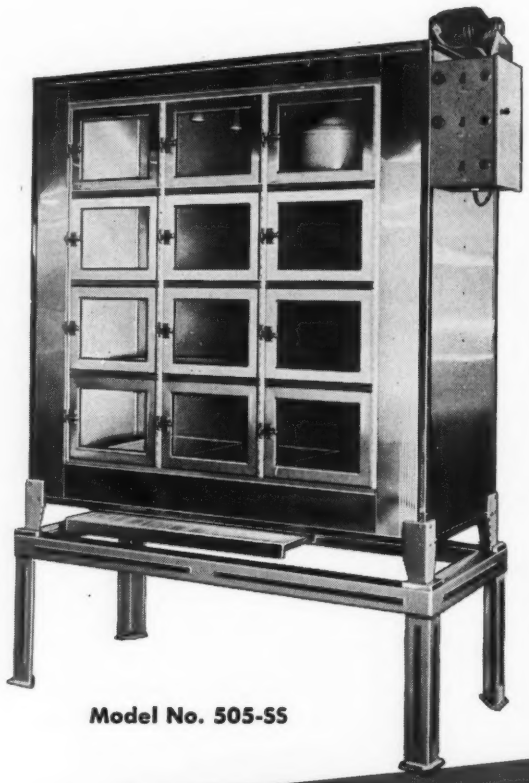

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CEREAL SCIENCE today

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COVER: A few of the numerous types of range cubes, pellets, and crumbles currently manufactured and sold in the United States for feeding poultry, swine and ruminants. Scale about one-half actual size. (Photo courtesy Pfizer Agricultural Research Center, Terre Haute, Indiana.)

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Editorial

How well do we do our jobs? Frequently the answer depends largely upon how sharp we keep our tools and whether we are aware of both their capabilities and their limitations.

The tools of the cereal chemist are scientific and technical knowledge, the methods he uses in the laboratory, and the apparatus that these methods employ. The AACC might be thought of as a tool-sharpening agency. The meetings, sectional and national, the publications, and the committee work all focus attention on the importance of effective communication, as well as the development of new knowledge. In a forward-thinking organization new ways of doing the tool-sharpening job must be devised and tried. That which was once the best will always be superseded by something better.

Elsewhere in this issue of Cereal Science Today are announcements of two new programs designed to help solve problems that are not so new. They are both extensions of technical committee work.

A five-session work shop devoted to farinograph technology will be sponsored by the Physical Testing Committee at the American Institute of Baking, May 5th and 6th, immediately following the AACC's Chicago meeting.

A new service is being planned by the Sanitation Methods Committee. It will offer flour and corn meal sanitation analysts who participate an opportunity to have their separation and identification of foreign material in collaborative samples reviewed and individually reported back to them by one of the Committee's panel of experts.

We believe that the individuals who are responsible for the planning and implementation of these programs should be commended for their efforts and are deserving of all possible encouragement and cooperation from individual members of our association.

Paul E. Ramstad

DOUGH MIXING AND BREAD FLAVOR

Technology of Continuous Dough Processing

By K. L. Fortmann, Baker Process Company
(Division of Wallace & Tiernan, Inc.), Belleville, N. J.

DOUGH MIXING AND flavor of bread may seem a rather strange combination, but the connection should become clear a little farther along. Considerable research is being devoted to the flavor of bread. J. C. Baker and H. K. Parker, among others so engaged, have devoted much of their lifetime to this field and much of their researches to dough mixing. To them, grateful acknowledgment is made for inspiration, help, and guidance in the studies discussed here.

What do we mean by the mixing of dough? What is optimum mixing, and what is overmixing? Is any specific motion or movement needed?

Premix Stage

Let's review briefly some phases of dough mixing. The first action is assembling ingredients; then solid and liquid materials are incorporated until the total mass is sufficiently mixed to have no obvious dry lumps or unusually soft portions. This is called the premix stage. The dough has a granular appearance; it is rather smeary, and breaks when pulled. If an open mixer is used, adhesion to the containing vessel is greater than internal cohesion.

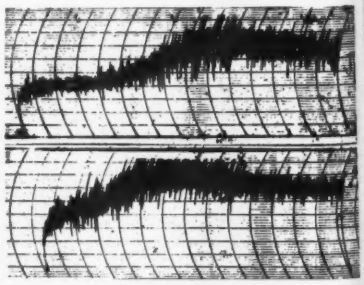
Development Stage

As mixing continues, the internal cohesion of the dough appears to overcome adhesion to the mixing vessel. The dough begins to "pick up." At the same time, the dough is "worked" more. It becomes smoother and drier, and reaches a peak of power consumption; it assumes a velvety appearance, and its film-forming characteristics improve. At this stage some important things occur. The dough has reached the right condition to capture appreciable quantities of air into its mass during the mixing. This action is of far-reaching significance, as will be discussed later. However, the dough must first be developed to a particular stage before it can contain or envelop appreciable gas. If mixed further it becomes more extensible, softer, more runny. The amount of gas enveloped does not appear to increase much beyond the optimum mixing stage. In fact, an overmixed dough will let go of the gas after the mixing has stopped.

During our studies on mixing, the essential motions were investigated. Most important of these is stretching and folding. Actions of an intense shearing or rubbing type appear to be undesirable. Much work can be done on the dough by certain motions which raise its temperature appreciably, without resulting in "development" or optimum film-forming and gas-retaining capacity.

Action begins as soon as the flour is moistened with either water or ferment. If there is much damaged starch in the flour, it will rapidly take up the water. At the same time, the protein portion of flour will compete for water and form gluten. If the starch granules are largely intact, the protein will receive most of it during the mixing stage. The latter condition appears to be optimum for all-round best bread production, because if the flour protein imbibes the water during mixing, it contributes in large measure to good dough structure, to best film-forming properties, and to optimum gas retention. Under these circumstances, a continuous gluten structure has formed. However, if an excess of damaged starch is present, it will form a kind of glue. The protein will receive some water too, but the dough structure will be largely a starch-to-starch or starch-to-gluten bond rather than a continuous gluten structure.

In the mixing curves of two flours, the top curve was made with a flour containing a low amount, and the bottom curve high quantities, of damaged starch. As the shapes of the curves indicate, flour 1 (top) hydrated rather slowly, whereas flour 2 (bottom) picked up the water fast. Flour 2 required very high absorption and, while the dough appeared to proof satisfactorily, it was lacking in oven-spring and gas retention. Loaf volume was low, and grain and texture were poorer than in the bread made with flour 1.



Mixing curves of two flours containing damaged starch. Top, low amount; bottom, high amount.

Conventional vs. Continuous Processing

In general, the same principles which are in effect with the conventional process apply to the continuous one; however, there are differences

in the steps for accomplishing this, and everything moves faster.

In the conventional process, flour is fermented. The source of carbohydrate is the damaged starch which is converted to sugars by the action of diastase. In the continuous process, cane, beet, or corn sugar is fermented in a liquid system. The end-products in both cases are essentially the same, namely ethyl alcohol, carbon dioxide, and organic acids. Other minor constituents and intermediates also are formed. Some esters could be produced, because alcohols and acids are in the same medium. The end-products of fermentation, such as alcohol, carbon dioxide, and other acids, are dispersing agents for the flour protein. Therefore all reduce the mixing requirement, improve the dispersibility of gluten, and aid in producing better bread.

In the conventional process, dough is mixed to the correct stage for best gas retention. The cell structure of this dough when it comes from the mixer is rather irregular, but this is not significant, because the gaseous emulsion will be largely destroyed or damaged during dividing. The equipment used after dividing is necessary to reestablish the proper gas distribution in the dough which will result in best grain and texture. Rounder and overhead proofers are used to allow some gas formation, which is reoriented during molding. If everything is done correctly prior to molding, the dough and the resulting bread still may very well be ruined by improper molding. On the other hand, if the dough has been abused before this step, or if it has been improperly fermented or mixed, this cannot be rectified at the molder. In contrast, the continuous process almost simultaneously mixes the dough and creates an emulsion of uniform gas cells in it. In other words, the final grain structure in the bread is established during the mixing. As the dough passes through the mixing chamber, film-forming characteristics are being developed and gas is emulsified in the dough. The dough coming from the outlet port is a foam consisting of dough structure with microscopic gas cells uniformly distributed throughout the mass. At this stage, the dough is rather delicate and subject to flow damage. Doughs having good machinability sustain less damage than those which are bucky, brittle, and puffy.

European Continuous Mixers

A considerable number of continuous dough-making units are in operation in Europe. It is reported that Russia has over 200. Sweden has taken up the principle on a large scale and, in number of units in operation, is probably second in Europe. England and Germany are showing activity.

CONVENTIONAL SPONGE PROCESS

SPONGE MIXING
↓
4½ HOURS FERMENTATION
↓
8 TO 12 MIN. MIXING
↓
30 MIN. FLOOR TIME
↓
DIVIDING AND ROUNDING
↓
12 MIN. OVERHEAD PROOFING
↓
MOLDING–PANNING

CONTINUOUS PROCESS

AMERICAN

2½ HOUR LIQUID FERMENT
↓
CONTINUOUS MIXING-DIVIDING-PANNING

EUROPEAN

CONTINUOUS MIXING OF ALL INGREDIENTS
↓
CONTINUOUS BULK FERMENTATION
↓
CONVENTIONAL MAKE-UP

European units appear to vary in approach from those in this country. All ingredients are metered to a continuous mixing unit. The dough is extruded, subjected to bulk fermentation, and processed with conventional machinery. Far less mixing action appears to be needed. Baked goods do not require a dough of the same filming characteristics and gas retention as in this country. Generally speaking, loaf volume is half that of ours per unit weight. Bulk fermentation has been put on a continuous basis, and two systems predominate:

1. The mixed dough is extruded onto continuous belts or continuous troughs. As it moves along, it is fermented and the length of the belt or the speed of movement determines the time of fermentation.

2. For bulk fermentation, the dough is pumped from the mixer into a vertical rotating tank with segmented compartments. As one compartment is filled, the next comes into place until the first has made a complete turn. At this point the dough is extruded by gravity and is processed with conventional machinery. Fermentation time can be regulated by the speed at which these segments move, or by their capacity.

The chief disadvantage of bulk fermentation is that there is a lot of dough in process at any one time; with the American system, only the amount of dough in the proof-box is in process. Liquid ferments, of course, are relatively low in cost, and if anything goes wrong they can be discarded without great loss; this is not so with bulk fermentation, because after the flour is added, the baker has a considerable investment in it. The accompanying flow sheet compares the conventional sponge and continuous processes.

Odor and Flavor

The flavor of bread produced by the continuous process has had much discussion and comment. Everyone knows the difficulty of defining flavor, and no precise comparisons are available for measuring it objectively. Many think of flavor as something mysterious and very complex — which in fact it is. Also, flavor involves balance between trace compounds. It is not hard to impart a characteristic flavor to a baked product, but it is extremely difficult to establish a balance. The broad fields which make up bread flavor may be expressed as follows:

1. Flavor due to ingredients: This comprises the flavors of salt, sugar, milk, butter, honey, and many other components.

2. Flavor due to fermentation: Fermentation end-products — acids, alcohol, fusel oils, and other minor constituents — contribute to flavor. Baker and co-workers have reported on this.

3. Flavor developed during baking: Flavorful compounds and pleasant odors are developed during the browning reaction in the oven. Caramelization takes place, and aldehydes and other compounds are formed.

4. Flavor and odor compounds produced during processing: This may involve oxidation and reduction reactions and the action of enzymes, such as enzymatic oxidation in pres-

ence of air; and direct chemical oxidation by compounds such as calcium peroxide or chlorine dioxide working on flour fats and added fats.

Baker and co-workers (1) observed that the addition of some amino acids or hydrolysates of proteins to the liquid ferment or to the fermenting dough gave characteristic odors and flavor. To pursue this observation, an experiment was set up as follows:

Thirty grams of corn sugar and 0.25 g. of a given amino acid were dispersed in 100 ml. of water; 5 ml. of this mixture were placed in Pyrex glass test tubes and heated in an oil bath for 20 minutes at 130° F. The browning reaction in these solutions was recorded on a scale from 0 to 5, 0 being a clear color and 5 being dark brown. Odors were observed at the end of 20 minutes of heating (see Table I). Many, of course, were noticeable before that time. Some could not be described clearly.

Table I. Browning Reaction

Amino Acid	*Browning*	*Odors*
Corn sugar only	0	No odor
l-Proline	1	Buttered popcorn
Phenylalanine	3	Wilted rose, or pansy
dl-Methionine	4	Sulfurous, soupy
l-Leucine	4	Baked cereal and cheese
l-Tryptophan	5	Burnt-sugar
dl-Valine	5	Faint burnt-sugar or freshly milled grain

The corn sugar solution remained essentially clear and there was no pronounced odor. Proline produced a color rating of 1 and an odor like that of buttered popcorn. Phenylalanine produced a characteristic odor. The same was true of methionine and cystine, which gave a sulfurous odor like that of burning chicken feathers. Leucine showed considerable browning, and an odor like that of baked cereal with cheese was noted. Tryptophan gave a deep color and an odor suggesting that of burnt sugar, with some similarity to that of tree sap. Valine had a faint burnt-sugar odor, which was also somewhat related to that of freshly milled grain. Many other amino acids showed an effect. Some materials containing appreciable amounts of different amino acids, like corn steep liquor and protein hydrolysates, produced a very noticeable effect when added to the ferment or to the dough formula. Evidently these odors are produced during deamination of the nitrogen-containing bodies by the yeast and during the browning reaction as the dough is baked. These products may be classified as carbonyl compounds chiefly consisting of various aldehydes and possibly ketones.

Odor and Flavor Produced During Processing

Soon after the continuous mixing process was started and when hydrogenated shortening was used, bakers described the bread flavor as bland. After further investigation, preference for a wheaty, nutty, yeasty, or fermented flavor was expressed. Among commercial bread sampled, some had the nutty-wheaty flavor, but some tasted soapy, "old-bakery," and rancid. Continued study indicated some correlation between the so-called nutty or wheaty odor and flavor and oxidized fats; that is, the flour fat or the added fat.

At this time also the British batter process was being looked into. This technique was developed as a maturing action for dough. A thin batter, of the order of 100% absorption of the flour, was mixed at rather high speeds until the power peak occurred. At this stage, or just prior to it, the dough would pick up in the mixing chamber, begin to slap, and envelop large quantities of air. The batter process accomplished a maturing action and a bleaching action simultaneously. This could already be observed on dough. At the same time, in some cases the wheaty-nutty odor and flavor, which may be designated as oxidized fat flavor, was noticed. This flavor was enhanced when the "whizzing" was done in an atmosphere of oxygen, and reduced in an atmosphere of nitrogen. Addition of soya lipoxidase speeded up the action. Thus, gradually the loose ends were tied up.

There is a rather long mixing period with the conventional process, in an open mixer. Evidently appreciable oxidation of flour fats and added fats takes place during this period. This oxidation process is helped along by the addition of oxidases. It may also be accomplished by certain oxidizing agents which are fat-soluble. For instance, if flour is treated with a high level of chlorine dioxide, an oxidized fat flavor can be produced in the baked product. Addition of calcium peroxide also has a tendency to produce this flavor. If this situation gets out of hand, of course, rancid, disagreeable odor and flavor will result. However, when this action is carried to the right stage and no farther, very pleasant odors and flavor will be produced which may be characterized as nutty and wheaty.

The conclusion may be drawn that this action is minimized in a continuous mixer, where the mixing time is short and where air is virtually absent. This also may very well correlate with the need of more oxidizing agents in the continuous mix than with the conventional mixing system. On going a little deeper into this and by using established procedures for analyzing carbonyl compounds, we found that they were more predominant in bread with wheaty-nutty flavor and odor. In fact, when rancidity was present, the bread had a rather high carbonyl content. Data in Table II confirm some of the theoretical aspects.

Table II. Carbonyl Compounds in Bread

Variations	*mg/g crumb*
Conventional bread	0.096
Continuous mix bread	0.041
Continuous mix bread plus oxidized lard	0.244
Laboratory bread — open mixer	0.044
Laboratory bread — oxygen mix	0.084
Laboratory bread — oxygen mix plus lipoxidase	0.120

Some volatile cleavage products of fats that have been identified are crotonal, hexanal, heptanal, decanal, undecanal, 2,4-decadienal maleic dialdehyde, and di-N-propylketone.

Preferences in Flavors

Sometimes the need is expressed for "mysterious," "exotic," and "difficult-to-describe" flavors, and perhaps this is met when a proper balance between the different flavor components has been reached. At the same time, adjectives like *mysterious* and *exotic* can hardly describe a flavor accurately.

In commercial bread, all the four groups of flavors and odors of various origins, enumerated above, are needed. Many bakers enjoy good business in bread with flavor based largely on ingredients like sugar, milk, butter, and honey. Others meet a demand for the flavors and odors due to fermentation and the browning reaction, and still others for those resulting from the mild oxidation of fats and subsequent production of

(Please turn to page 308)

RESEARCH ON RICE AT THE

Southern Regional Research Laboratory

By Marie A. Jones, Southern Regional Research Laboratory,[1] New Orleans, Louisiana

RESEARCH ON RICE has been a part of the program of the Southern Utilization Research and Development Division since its inception in 1939, when Congress authorized the four USDA Regional Research Laboratories.

Grain research in the Southern Division is limited to rice, as this is the only one of the grains for which the South is the major producing area in the United States. Large quantities of wheat, corn, and other grains are grown in this area, but their importance is overshadowed by that giant of both the agricultural and industrial worlds, King Cotton.

The Southern region is the source of about three-quarters of the rice produced in this country, and includes three of the major rice-growing states: Arkansas, Louisiana, and Texas. During the 1945–1954 period, Texas produced a yearly average of 11,837,000 hundred-pound bags, Louisiana 11,639,000, and Arkansas 9,272,000. Another major rice-producing state is California, with an annual average of 9,442,000 bags during 1945–1954. Since 1954, rice production in each of these states has fluctuated between 11 and 15 million bags a year. Several other states in the Southern region produce rice in smaller quantities.

Differences in Varieties

Most of the rice grown in California is of the short-grain varieties, whereas that produced in the Southern region is almost entirely medium- or long-grain. Properties of the Western and Southern types vary widely. Most long-grain rice is dry and fluffy when cooked; the short-grain is sticky or cohesive. Because of these differences, two distinct programs of rice research have been found desirable, and investigations are going on in both the Western and Southern Divisions.

During the nearly 20 years which have elapsed since establishment of the Southern Laboratory, the rice utilization research program here has ranged over a wide field, from process engineering developments through microbiological studies and chemical investigations of the constituents of rice. This wide variety of research projects has come about through the policy of adapting the research program to the needs of the rice industry as these needs change with changes in economic and other influences.

Rice ranks with wheat as one of the oldest-known food crops. It would be difficult if not impossible to prove which of the two was first domesticated and cultivated for food, because both go back beyond the days of recorded history.

In spite of its antiquity, however, and even though rice is still the major source of calories for a large portion of the world's population, knowledge of its chemistry and technology has lagged behind that of most of the other grains. This is due largely, no doubt, to the fact that rice makes a delicious food with very little special preparation. Boiled until the grains are tender, rice is a basic dish throughout a large portion of the world; variations come in the adjuncts, such as seasonings or sauces, or in the matter of whether the grains stand apart, firm and distinct, or cook down into a gelatinous mass.

In the southern United States, most people prefer the former type. In Japan, where rice is a food staple, the sticky varieties are favored. Many people blame cooking methods for the difference, whereas experimental studies indicate it is primarily a varietal characteristic.

These differences in cooking quali-

The Southern Regional Research Laboratory in New Orleans, La., is administrative headquarters and the principal laboratory of the Southern Utilization Research and Development Division of the Agricultural Research Service, USDA. The Southern Division serves an area including Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, and Texas. Commodities studied are cotton; cottonseed, peanuts and other southern-grown oil-bearing materials; rice; sugarcane; citrus fruits; sweetpotatoes, cucumbers, and other vegetables; pine gum; and the products and by-products of these crops. In addition to the Southern Laboratory, the Division includes five field stations, located in Houma, La.; Olustee, Fla.; Winter Haven, Fla.; Raleigh, N. C.; and Weslaco, Texas.

[1] One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

Rice is the only major cereal grain which will sprout under water and grow in a flooded field. Flooding is not necessary, but is an economical and effective way of keeping weeds out of the crop, and most rice in the southern region is grown under water. This irrigation water is pumped from wells onto the fields, as shown above. The fields are drained a short time before harvesting to allow the ground to dry sufficiently for passage of the combines.

ty, their relation to variety, and the variations in composition which cause such differences, have been the object of considerable research at the Southern Division, especially recently. This difference is the chief distinguishing factor in rice quality from the standpoint of the consumer, and is of major importance in rice marketing. Preference for dry, fluffy rice, or for soft, sticky rice may be personal, regional, or national, but whichever is preferred, the consumer wants to be sure of getting the kind of rice he likes every time.

The rice farmer growing a crop for marketing in the southern United States or perhaps in Australia, where the majority of people want dry fluffy rice, would plant that variety; but if he is growing the crop for export to Japan, he would do well to plant sticky, gelatinous varieties. To meet this desire for certain types of rice in certain areas, and also because the factors which determine cohesiveness or separation may be important in other ways, properties which affect cooking quality are being investigated.

Current Research

Relationship between cooking quality and other properties of ten varieties of rice has been established by investigations of hydration characteristics under carefully prescribed experimental conditions. Samples used in the tests were brought to approximately the same level of moisture by subjecting them to a presoak period at room temperature for 30 minutes, at which time all of them reached a moisture content of approximately 36–38%. This was found necessary because otherwise variations in initial moisture content of the different samples had been found to influence results of the hydration tests. These tests were carried out at 70° C. for 20–30 minutes. High water-absorption values were indicative of poor cooking quality and stickiness when cooked. Long-grain rices, which cook to a dry fluffy state without being sticky, were characterized by low water-absorption values. Loss of undissolved solids to the cooking water follows a similar pattern, being greatest for the short-grain and least for the long-grain rices.

Hydration characteristics and cooking properties appear to be related to the comparative predominance of amylose and amylopectin within the grain. Of rices studied, those with low amylose content (13–15%) absorbed more water than those with higher proportions of amylose (19–22%). Cohesiveness and losses of solids in cooking also increased with the smaller amounts of amylose.

An interesting inconsistency in the results was the fact that although Century Patna is a long-grain rice, it behaves more like a medium-grain type in water absorption and the amount of undissolved solids. This suggests that the hydration test might be used to detect rices that are not true to type in cooking and processing characteristics.

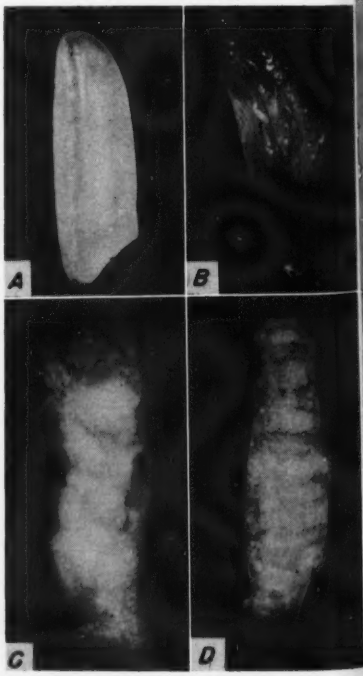
Three processed rices, one of which was parboiled and the other two quick-cooking rice, and samples of a single variety dried at vari temperatures, were included in th investigation. Water uptake w much higher for the three proces rices than for raw milled rices similar type.

Freeze-Processing

As another approach to investig tions of the constituents of rice a their behavior under various con tions, freezing was selected. T choice was made because of t known effect of freezing on star pastes. More than a century a Scharling observed that when star pastes are frozen and thawed the form a spongelike mass. Sinc starch comprises approximately to 90% of the rice grain, a freezin technique seemed promising for i vestigating rice characteristics, pa ticularly hydration.

Results of the investigations ind cated that both structural and chem cal changes take place during th freeze-processing. One step foun essential to structural alteration wa that the cooked samples should pas through the freezing zone very slow ly. The conditions required were tha the rice be fully gelatinized an brought to a moisture content o 60% or higher, then either rapidl frozen and very slowly thawed, o very slowly frozen and then dried a

Photomicrographs (7× magnification) of mille rice: A, Rexoro, uncooked; B, Rexoro, cooke and dried; C, Rexoro freeze-processed; D, u known variety, commercially processed.



a low temperature. Long-grain varieties were changed to the greatest extent and had the highest water uptake, as much as 73% in 1 minute at 25° C. When Rexoro, a long-grain type, was treated in this manner and reconstituted in hot water, it was organoleptically similar to raw rice cooked in the usual way. Properly freeze-processed rice was enlarged, chalky white, and spongelike or porous in texture.

This treatment had less effect on medium-grain rices, and almost none on a short-grain waxy rice.

Changes produced by freeze-treatment proved to be both structural and chemical. Certain changes observed in freeze-processed rice have been shown to be similar, if not identical with, the starch retrogradation associated with bread staling. This change has been recognized and studied for a long time in research on other grains. The observed similarities in the two phenomena may provide a key which will open the door to more knowledge about the differences in rices and possibly how to control these differences.

Freeze-processed rice was found to be more resistant to attack by the enzyme, beta-amylase, than the unfrozen control, but this resistance was almost completely neutralized by preheating to 45° C. or higher.

Research on Aging

Another study under way at the present time is that of the effects of aging on rice. People in the rice industry generally accept the idea that rice aged for several months is less cohesive and shows less tendency to disintegrate when cooked than does freshly harvested rice. Quantities of Bluebonnet 50, a long-grain, and Zenith, a medium-grain rice, both milled and rough, have been placed in storage under controlled conditions. As a viable seed, rough rice is an entirely different entity from the milled product, as milling removes the germ, hull, and bran. In the aging studies, it is desirable to know what effect, if any, these elements of the seed structure have on changes in properties of the grain.

Samples are being analyzed periodically for starch, free fatty acids, nitrogen, protein solubility, and amylose, as well as the determination of hydration characteristics. At the end of approximately 5 months the only appreciable change was an increase in the free fatty acids in the rough rice samples. There has been a gradual improvement in cooking quality, although the cause of the change was not revealed in the chemical analyses. Technical examination is being extended in an effort to discover the nature of the alteration responsible for the improvement in cooking quality.

Other Current Research

In another phase of rice research, during the 1958 harvest season representatives of the Engineering and Development Laboratory of the Southern Division participated in a project aimed at adapting the rice drying method developed in the Western Division. Representatives of the Western Division and other federal agencies, and state agencies in Louisiana and Texas, also took part in the project, which was carried out in a Louisiana commercial rice mill. Experiments with medium-grain rices were sufficiently successful to lead to commercial application of the process in the plant where the tests were made. Because of weather and other conditions beyond the workers' control, tests on long-grain rice were not considered conclusive.

To develop information as to where U.S. rices fit into the world picture, and to gain specific knowledge about the kinds of rice consumed in various countries, a comprehensive study of foreign and domestic rices is now being made. Participating in this study are several USDA agencies, including the Southern, Western, Crops Research, and Human Nutrition Divisions of the Agricultural Research Service, the Foreign Agricultural Service, and the Agricultural Marketing Service.

The Southern and Western Divisions are analyzing samples for amylose, total starch, surface lipids, total lipids, protein, moisture, crude fiber, and ash. Each of these divisions is to test approximately the same number of samples; short-grain samples are being assigned to the Western, and medium- and long-grain samples to the Southern Division.

The Foreign Agricultural Service is supplying samples. The plan is to obtain representative samples from all the rice-producing countries of the world and from most of the rice markets. Altogether, several hundred samples will be examined, tested, and classified.

The Human Nutrition Research Division is conducting studies on cooking properties, and the Agricultural Marketing Service is grading the samples in accordance with official standards.

When the project is completed and the information compiled, this knowledge should be valuable to growers and processors producing rice for export. A measure of the importance of this kind of information is the fact that almost half of the United States crop goes to foreign markets.

This summarizes recent and current research at the Southern Division. Future investigations, according to present plans, will emphasize study of the changes which occur in rice during processing and aging. The ultimate goal of such investigations is better control of rice quality, a possible basis for new products, and altogether, improvement in the market position of this product.

Research Developments of the Past

The first rice utilization research at the Southern Regional Laboratory, begun soon after its establishment, was aimed at improving the economic position of the crop through new and profitable outlets for by-products. This is always one of the most promising sources of better returns for the growers and processors of any crop.

Oil Extraction

The principal use for rice bran has always been as feed for livestock. Research workers at the Southern Laboratory began a study of extraction of oil from the bran. Standard extraction procedures, as well as the filtration method of solvent extraction developed in the Southern Division, were adapted to this material. By adding one step to the filtration-extraction process, a wax similar in many of its properties to carnauba and other high-grade imported vegetable waxes can be obtained.

Investigation of the properties of rice bran oil showed it to be an odorless, colorless product of excellent quality for cooking and other food uses. Losses during refining of rice oil by ordinary methods are higher than for most oils of the same type. It was determined that such losses can be reduced by the addition of amino- or hydroxyl-containing com-

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EFFECTS OF COMMERCIAL FEED PELLETING OPERATIONS ON MICROINGREDIENTS[1]

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THE PELLETING OF livestock and poultry feeds has progressed rapidly during the last 30 years. What was once a novelty and a curiosity has now become an accepted and required manufacturing operation, of importance fully equal to that of mixing. In 1958, the feed industry's total annual production volume reached a record of 40 million tons. Table I gives a breakdown by type of feed product, based on recent tabulations of the American Feed Manufacturers Association (1).

TABLE I
1958 ANNUAL FEED PRODUCTION, U.S.A.

TYPE	MILLION TONS PRODUCED	PERCENT OF TOTAL	PERCENT INCREASE OVER 1957
Swine	5.6	14	+35
Beef and sheep	2.4	6	+20
Dairy	6.8	17	...
Broiler	8.0	20	...
Turkey	2.0	5	...
Layer-breeder	13.2	33	...
Other	2.0	5	...
Total	40.0	100%	

Volume of Pelleting Operations

Of the 1958 total of 40 million tons of feeds, it has been conservatively estimated that 55%, or over 22 million tons, has received some type of pelleting operation. Table II shows the extent to which feeds are pelleted, crumblized, or cubed (4), comparing the national over-all totals to regional totals for the West-Central states. In these states, almost 80% of all manufactured feed is either pelleted, crumblized, or cubed; for the entire country, the estimate for all commercial poultry feeds is more than 80% pelleted and/or crumblized (7).

TABLE II
EXTENT OF USE OF FEED PELLETING OPERATIONS

	ALL U.S. (100%)[b]	CENTRAL STATES[a] (26%)[b]
	%	%
Pellets	27	34
Crumbles	22	32
Molasses pellets and cubes	6	12
Mash	45	22
	100	100

[a] North and South Dakota, Nebraska, Kansas, Oklahoma, Texas, Minnesota, Iowa, Wisconsin, Missouri, and Arkansas.
[b] Percent of total national feed volume.

Reports on the advantages of pelleting are numerous in the technical journals and feed trade press. While a review of the literature is beyond the scope of this paper, a search was made for technical data on variables in the pelleting process and their effects on microingredients. It was surprising to find that after 30 years of industrial application, published reports on this important process are virtually nonexistent. It is the aim of this paper to bring together some pertinent estimates and facts, and to present results of typical laboratory and plant studies.

Microingredients

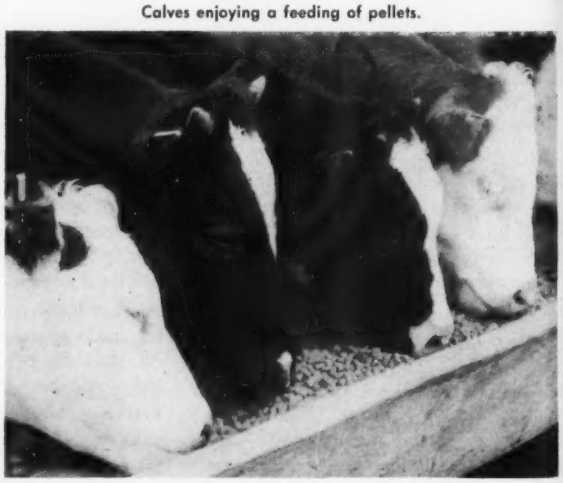
The remarkable advances that have been made in animal nutrition and veterinary medicine in the last decade have brought out many new feed additives which not only improve both rate of gain and feed conversion, but also combat many diseases. Today, most commercial feed formulas contain 20 to 30 different microingredients, in the following categories (6): vitamins, antibiotics, minerals, drugs, amino acids, antioxidants, unidentified growth factor (U.G.F.) sources, enzymes, pigmentation sources, preservatives, flavors, and others.

The data in this paper will deal only with vitamins, antibiotics, and drugs. However, it is emphasized that microingredients in other categories are fully as important, and exhibit equal or greater sensitivity to commercial pelleting.

Variables in the Pelleting Process

The very nature of feed pelleting renders it almost immune to precision and standardization. The operation itself might be considered a variable, since conditions and results are exceedingly difficult to duplicate from day to day, and sometimes even from run to run. Some of the major variables in this operation are composition and texture of feed; uniformity of mash; steam temperature, pressure, and rate; operating conditions and operator;

Calves enjoying a feeding of pellets.



[1] Presented at the 44th annual meeting, Washington, D.C., May 1959.
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pressure in die; pelleting temperature; equipment used; die condition; pellet size; and recycling of fines.

Feed Composition

It has long been recognized in the industry that composition of the mash exerts a profound effect on such factors as production volume, die wear, fines produced, pellet hardness, and steaming required. We therefore considered it impossible to develop meaningful data on the comparative stability of microingredients in pellets, unless feed composition was held constant. In very early tests in our laboratories with eight different commercial pelleted feed formulas, the 2-month retention of the same lot of vitamin A product varied from 54 to 98%. A simplified broiler diet was therefore selected and employed in every test. As far as possible, identical grinds of each bulk ingredient were used. The experimental feed composition is shown below:

Composition of Experimental Broiler Feed

Ingredient	%
Ground yellow corn	59.3
Soybean oil meal (44%)	19.0
Ground oats	5.0
Meat scraps (50%)	3.75
Alfalfa meal (17%)	3.75
Wheat mixed feed	2.5
Fish meal (60%)	2.5
Limestone flour	1.50
Defluor. phosphate	0.75
Salt, iodized	0.35
Nicarbazin (25%)	0.25
3-Nitro powder (10%)	0.0375
Trace mineral mix	0.15
AB-vitamin premix	1.00

It should be emphasized that a formula of optimum nutritional balance was not our objective in this work. Pellets of satisfactory hardness and appearance were produced in each test with this ration.

Test Conditions

In view of the numerous variables which influence pelleting, listed two sections above, it was essential to attempt further standardization of test conditions. Simply using the same feed formula was only one step; as many other variables as possible were eliminated. All tests over the past 6 years were conducted on a commercial scale in a near-by feed mill, using the equipment and procedures outlined below.

Manufacturing Equipment and Conditions

Batch size: 1000 lb.
Feed mixer: 1-ton capacity, vertical screw type.
Premix size: 1% of batch, minimum.
Mixing cycle: 15 minutes.
Pellet mill: California "Century" model, 50 h.p.
Pellet mill and die thoroughly preheated before use by a prior run.
Pellet size: 3/16 in.
Steam pressure: 80–90 p.s.i.g.
Temperature and moisture recorded at every step.
Pellet cooler: California Model 2-A-2, vertical, 1½-ton capacity.
Pellet sifter: B. F. Gump "Bar-Nun" sifter.
Fines separated and weight recorded; *none recycled.*
Assays made within 12 to 24 hours, and again after storage.

Because early studies showed wide variation in percent fines produced from test to test, we standardized by separating all fines and recycling none. While this does not represent commercial practice, it provided our only means of obtaining meaningful comparisons. Our data are therefore based on a single pass of the entire batch through the die. This treatment is obviously less severe than is encountered in practice, and our data must be interpreted accordingly.

Recycling of Fines

Fines produced anywhere in the process stream — pellet mill, conveyors, coolers, sifters, crumbling rolls, bins, etc. — are routinely returned for repelleting. This recycling is expensive; it greatly reduces production rates, and existing stability problems are aggravated by the repeated steaming and by the effects of compression and temperature. The importance of minimizing fines is therefore apparent.

In 56 test batches of pellets produced during the last 5 years, the percent of fines, under our controlled conditions, varied from 6 to 15%, averaging 10%. In 8 recent batches containing 3% added fat, the average rose to 24%, with a range of 19 to 27%. In crumblizing, it has been estimated recently, fines will range from about 15 to 25% additional. Thus, in commercial practice, it is not uncommon to find over 25% of the batch being recycled.

Pressure During Pelleting

No data are known on the exact magnitude of instantaneous maximum pressures occurring in the die during feed pelleting. It is known that some special alloy steel dies, fabricated to withstand about 100,000 p.s.i. tensile stress, have occasionally failed under peak loading during pelleting. One manufacturer of dry steamless pellet mills reports that his equipment exerts pressures up to 65,000 p.s.i. (2).

High pressures deform and/or crush friable materials such as crystalline microingredients. With reduced particle size there is more exposed surface area of ingredients and hence greater susceptibility to decomposition. At the same time, compression places sensitive additives in more intimate contact with other incompatible ingredients. It seems very likely that pressures in the die on steamed pellets may exceed 20,000 p.s.i.

Temperatures

Many feed manufacturers think of pelleting temperature only as that of the hot pellets just as they leave the die. It is logical to expect that instantaneously, within the die itself, temperatures are significantly higher. Here again, there seem to be no published data. Among factors that influence pellet temperatures are mash and ambient temperature; steam rate and temperature; feed composition; liquid added; pellet size; roll settings; compression and friction in die; die condition; conduction by die; expansion leaving die; moisture evaporation; and production rate.

In 5 years of commercial pelleting experiments under the controlled conditions described above for composition and manufacturing, we found substantial and uncon-

trollable variation in temperature from test to test. The steamed mash varied from 108° to 153° F.; the hot pellets off the die varied from 138° to 180° F. Temperature increases in the pellets over the steamed mash were 20° to 45° F.

In view of the above and related observations, we believe that the instantaneous maximum temperature of steamed pellets, while still inside the die, may exceed 225° F. Such high temperatures release bound moisture in cereal and animal protein ingredients, as well as water of crystallization in mineral salts. This accelerates decomposition through partial dissolution and by increasing reactivity. Also, animal fats, stabilizing wax coatings, and several microingredients will melt. The trend in the last 2 or 3 years has been to higher and higher temperatures without due regard to possible adverse effects.

Sources of Microingredients

Not so widely known are the beneficial effects of pelleting on the undiluted microingredient sources. Many additives may possess undesirable characteristics because of inherent physical or chemical properties and/or manufacturing processes employed. Ingredient manufacturers have evaluated pelleting on many products. Their results have made it possible to reduce hygroscopicity, eliminate static electricity problems, improve flow properties, decrease dust losses, and obtain better performance in automatic feeders and more efficient mixing, with less caking difficulties.

Uniformity of the Mash

The problem of uniformity is often overlooked by feed manufacturers. Products to be sold in mash form are generally formulated and handled very carefully to ensure uniformity, but when the mash is to be pelleted, specifications are sometimes relaxed to the extent that pellets and crumbles are not uniform. This is obviously of most importance in poultry rations, with their low daily feed intakes.

Some of the factors causing nonuniform mash are: 1) wide variation in particle sizes of ingredients; 2) vibration and sifting; 3) static electricity problems; 4) insufficient microingredient particles per gram of mash; 5) incomplete mixing; 6) inaccurate performance of automatic feeders; and 7) inadequate sampling and/or assay methods.

Stability tests and feeding results can be extremely misleading if nonuniformity is not carefully eliminated as a variable. This can generally be done by proper premixing, and by milling of bulk ingredients as required. Fat or molasses serves as a "sticking agent" to retard sifting. Sampling and assay methods must be specifically adapted to the characteristics of the product in question.

Laboratory-Scale vs. Plant-Scale Tests

Commercial-scale tests for evaluating new and existing products are slow and expensive. The search has been long and continuous, in many laboratories, for a "quick test to simulate pelleting." A number of approaches ha been suggested and are in limited use, such as accelerat temperatures, high humidities, autoclaving, steamin adding water to the sample, and incorporating hi mineral levels.

None of these can be considered equivalent to co mercial pelleting. When properly interpreted, such te may sometimes be useful for initial screening purpose but in our experience the ultimate criterion has alwa been performance in feeds pelleted under commerci conditions. Recently a number of laboratory-size pell mills have become available. Whether such equipment wi duplicate results from plant-scale mills must be dete mined in each individual application. To date, no know data are available on such correlation.

Retention of Micronutrients

It is occasionally reported that pelleting may impro stability. The fat-soluble vitamins and xanthophylls wer originally thought to be more stable in alfalfa pellet than in meal, but subsequent tests showed no significan advantage. A few feed formulas have been noted in which stabilized vitamin A oils retained their potency somewha better in pellets than in mash.

There has been extensive interest in recent years in converting forage crops and roughages into pellets and wafers. It is not yet known whether such processing may enhance the retention of micronutrients. This would be an area worthy of study.

Vitamin Stability: Fat-Soluble Group

Because of its sensitivity and ease of assay, vitamin A has been more widely studied for stability in feeds and pellets than any other vitamin. The results of four years of our commercial pelleting trials are shown in Table III. The identical ration composition, equipment, and conditions described above were employed in all tests. Because of these elaborate precautions, we believe the averaged results are significant. The data in Table III are taken (in part) from a recent publication (5).

TABLE III
STABILITY OF VITAMIN A IN BROILER PELLETS

Vitamin A Product	Different Batches Tested	Potency Retention at Room Temperature[a]		90-Day Range
		30 Days	90 Days	
		%	%	%
Pfizer A-250-P Dry A	24	86	73	57–93
No. 1	5	84	66	47–82
No. 2	2	78	53	50–55
No. 3	1	77	48	48
No. 4	2	67	35	33–37
No. 5	2	81	58	58
No. 6	1	81	67	67
Vitamin A oils	4	63	24	15–36

[a] Feed was supplemented to contain 10,000 U.S.P. units/lb. Initial pelleting losse were not significant. Assay precision = ±8%.

It must be emphasized that the averages in Table II apply to one feed only, produced in one mill under a fixe set of conditions. Absolute values for potency retentio will vary in other feeds and on other equipment. Th

trends and relationships, however, appear to be significant. All of the vitamin A sources tested are commercially available, and are sold specifically for feed use.

Because the fat-soluble vitamins are quite sensitive to oxidation, temperature, moisture, etc., it seems reasonable to predict that vitamin D, E as natural tocopherols, and vitamin K will be unstable under any conditions which decompose vitamin A. Unfortunately, the lack of suitable feed assays for these three vitamins has hampered stability studies. Very few data are therefore available, and overages are generally added to most feed products.

Vitamin Stability: Water-Soluble Group

The members of this group vary widely in stability in feeds and pellets. One might predict that in feed the moisture and steaming would be generally detrimental to water-soluble vitamins. Fortunately, this is not the case. Choline and niacin are considered to be highly stable. This applies also to riboflavin, although its stability is occasionally poor; actual testing is necessary to establish this.

Calcium pantothenate is unstable in the presence of moisture and acid pH values. The lack of data on the stability of this vitamin and the occurrence of pantothenic deficiency symptoms occasionally in the field suggest a need for study in this area. Vitamin B_{12} has shown good-to-poor stability in pellets, depending on the source studied. In general the cyano-cobalamin form is most stable. Reducing agents such as ferrous sulfate, and also bisulfites, may raise compatibility problems.

Vitamin C, used in feeds for guinea pigs and monkeys and quite recently in laying rations, is extremely sensitive; initial losses after pelleting may run 25% and higher. Stability in stored pellets is also very poor, and potency generally falls rapidly, particularly during the summer. Studies are under way to reduce this problem.

Few data are available on the stability of folic acid, thiamine, pyridoxine, and biotin in feeds and pellets. Each of these is known to be sensitive in solution form, and some destruction in stored pellets would seem likely. However, assay difficulties have hampered research on these important nutrients.

Stability of Antibiotics

The antibiotics employed in feeds today are compounds having complex chemical structures. Although they are all classed as inherently sensitive, some products are more stable than others. Early studies in our laboratories indicated that commercial penicillin sources varied widely in stability in stored pellets. Typical results from three original tests are summarized in Table IV. Again tests were conducted as outlined above for ration composition, equipment, and conditions. The results indicated that certain types of high-quality pharmaceutical procaine penicillin were relatively unstable in feeds and pellets. Data confirming this have been reported by others in the literature (3). Specially prepared grades for feed supplementation, subsequently developed, have shown uniformly superior stability and are now available from a few basic producers.

TABLE IV

STABILITY OF PROCAINE PENICILLIN IN BROILER PELLETS

TEST NO.	PENICILLIN SOURCE	30 DAYS' RETENTION[a]	
		Mash	Pellets
		%	%
4.7–7	54002	61	18
	Product A-1	79	33
4.7–10	40657	91	78
	Product B-1	56	26
4.7–11	Product A-3	84	80
	Product B-2	57	21

[a] Storage at room temperature; assay precision = ±10%.

For comparison, average results are shown in Table V

TABLE V

STABILITY OF ANTIOBIOTICS IN BROILER PELLETS (4.7–61)

ANTIBIOTICS[a]	30 DAYS' RETENTION	60 DAYS' RETENTION
	%	%
Terramycin (R)	91	76
Aureomycin (R)	76	67
Bacitracin-Zn	74	55
Erythromycin-CNS	64	<20
Oleandomycin	88	81

[a] Antibiotics added as commercial feed supplements. Precision of microbiological assay = ±10%.

from recent tests on other leading antibiotics. Ration composition, equipment, and conditions were again identical. The values given obviously apply only to our own feed, equipment, and conditions. While the trends are significant, absolute values will vary significantly under different manufacturing conditions.

Assay Problems

No discussion of pelleting would be complete without mention of assay problems with microingredients. Lack of understanding of analytical difficulties, and incorrect sampling methods, are unquestionably major causes of erroneous data on stability. Unsuspecting laboratory personnel have sometimes been completely baffled by a change, presumably minor, in a feed formula.

Added fat often interferes with extractability during assays. Molasses, and milk solids at high levels, both have also made modifications necessary. The aqueous buffers are often replaced by organic solvents on high-fat feeds. Conversely, organic solvents do not always function well on molasses feeds and a switch must be made to aqueous buffers. High levels of bentonite may be troublesome in certain formulas, by preventing the complete extraction of Terramycin and Aureomycin. This possibility must be eliminated in assays on pellets, if results are to be meaningful.

Another perplexing problem is "aging" or "binding" of some drugs in certain mash and pellet formulas. This is not to be confused with loss of potency due to decomposition. Rather, the drugs seem to be tied up by some physicochemical linkage to protein or carbohydrate fractions in the feed. Extraction methods which are satisfactory for fresh feed blends do not extract all of the drug present in aged samples. More drastic methods are required, such as the use of hot solvents, special solvent

mixtures, and/or overnight extraction. The nitrofurans and diethylstilbestrol are examples of drugs which have required such assay modifications on older samples. This is a problem in industrial and regulatory laboratories where the composition or age of a sample is not known.

Many laboratories, as a common practice, grind finely all samples on receipt and store them at room temperature until a sufficient number have been accumulated to justify running an assay for a specific antibiotic, vitamin, or drug. Several days and even weeks may elapse in the interim. During such a delay, some microingredients have been known to partially decompose, owing to the more intimate contact and the increased surface area caused by milling. In our work, all samples are refrigerated or frozen until assayed. Only samples ready for immediate assay are milled. Experience over the years has convinced us that these are desirable precautions.

Conclusions

The increasing use of pellets, crumbles, and cubes, and the lack of data on these operations, point up the need for much more research. The feed industry would welcome studies by colleges and by manufacturers of equipment, aimed to reduce pelleting temperatures, pressures, steaming, and the production of fines without lowering production rates. Attention to uniformity of feed, variables in processing, methods of sampling, and applicability of assays will help obtain more meaningful data.

Initial pelleting losses are generally not significant, but may become sizable during storage, particularly in summer. Prompt feeding of pelleted rations is obviously desirable, plus adequate control of inventories to ensure rapid, systematic turnover. In this way the livestock and poultry raiser will derive maximum benefit from the many advances in nutrition and animal health which are an important part of today's manufactured feeds.

Acknowledgments

The authors wish to express their sincere appreciation to Graham Bros. Inc. of Washington, Indiana, for the use of their production facilities in the experimental pelleting trials during the last 6 years. Special thanks are also in order for the Chemical Laboratories Staff of the Pfizer Agricultural Research Department, who performed the hundreds of chemical assays, and for the Pfizer Vigo Plant Laboratories, for innumerable microbiological determinations.

Literature Cited

1. ANONYMOUS. News release, American Feed Manufacturers Assn., Chicago, February 11, 1959.
2. DUDLEY, A. *Farm Management 6:* 21 (Aug. 1958).
3. HOLLENBECK, C. M., DANNER, W. E., and MAHONEY, J. F. *Poultry Sci. 33:* 425 (1954).
4. KARSTENS, J. *Feed Age 8:* 46 (Nov. 1958).
5. LUTHER, H. G. Proceedings 6th Annual Research Conference, Agricultural Research and Development Department, Chas. Pfizer & Co., Inc., Terre Haute, Indiana, May 20, 1958, pp. 65–83.
6. WORNICK, R. C. Proceedings, 7th Annual Midwest Feed Production School, Kansas City, Mo., Dec. 3-5, 1956.
7. WORNICK, R. C., *Cereal Science Today 3:* 179 (Sept. 1958).

HERE'S A UNIQUE "IN-THE-LAB" TRAINING COURSE IN

Sanitation Analysis

By The Sanitation Methods Committee, A.A.C.C.

READ THIIS IF you are concerned with sanitation-analytical work. The Sanitation Committee now has in effect an *in-your-own-laboratory* program that will interest you.

Results on insect fragment counts may vary all over the map. What has caused this? There are many variables to consider carefully before any attempt is made to evaluate the results of sanitation analyses, but unless each problem or variable is resolved, one at a time, evaluations and standardizations that lead to uniformity are really impossible. The situation has been evaluated from time to time in various ways with emphasis placed on extraction, miscroscopes, visual acuity, and fragment recognition and identification. The Sanitation Methods Committee now proposes a program to lick the recognition and identification problem.

There has always been interest, enthusiasm, and cooperation for the activities of this committee and we want this work to benefit each participant in his day-to-day activities. This is vital. When we do this it will pay off technically and to management responsibility.

Phase One Completed

Only recently completed were the three sanitation schools held in San Francisco, New York, and Chicago, and these represented the successful activities of the Sanitation Committee last year. There was a very definite objective, namely, insect fragment recognition and identification, built on a sound foundation of insect morphology. And, although significant progress was made, considering the large number of participants and the short one-week session, there still exists considerable lack of uniformity in insect fragment analyses (sanitation analyses).

Plans for 1960

It would seem a shameful waste of the three schools to break into some new phase of sanitation work this year. Therefore, to maintain continuity and a common theme and, moreover, to continue with a phase which needs vast improvement, the program of the Sanitation Committee this year will be *"Standardization" of Insect Fragment Recognition.* We do wish it recognized that we appreciate the many other problems of sanitation analyses, certainly recovery procedure is one that must be settled soon. But, from a very critical review and appraisal of the entire subject we have concluded that *"Standardization" of Insect Fragment Recognition* be first order business before any collaborative, comparative and training work is undertaken on filth recovery methods. Lack of uniformity predominates in the microscopic-analytical phase. Obviously, the most reliable extraction method is a waste if the analyst is unable to accurately and confidently judge a filter paper in terms of insect fragments present.

Objectives

The plan which the committee has adopted borders on a personalized and specific approach to training in insect fragment analyses. FIRST, the plan is designed to determine the individual problems in insect fragment recognition and to help each participant *as an individual on specifics.* SECOND, it is intended for this plan to bring the participants together into a framework of *uniformity.* All of us realize that several factors contribute to variations in insect fragment counts. However, none of these factors should have any connection with the analysts' ability or knowledge of insect material. Insect fragment analyses can not be a matter of *good, better,* or *best.* The analyst either knows how to recognize insect debris or he doesn't; intermediate results ("high," "low," "average") are really not valid. There is no need to settle for such analyses, after the learning, the training, and a reasonable experience period is completed. One analyst may see more than another for many reasons, but this does not mean or should not mean that one knows more than another when each is called upon to recognize and count the number of insect fragments present. Sanitation analyses should not be a matter of personal feeling or attitude or based on the "majority rule" method; rather it should be based on as sound a scientific approach as can be applied. It would seem that this must be the case if the analysts' (government, industry, private) results are to be reliable and meaningful.

For the next several months we will conduct a *correspondence school in insect-fragment recognition.* If you would like to be a participant in this training work (training work that will be theoretical or based on planted material, but work that can be applied in your day-to-day fragment analyses) you will be interested in the following course outline:

1. Each participant will receive periodically a 50 gram sample of flour or corn meal. (The corn meal sample has been included in answer to several requests.) These samples for the most part will be from the grocery shelf. We will know beforehand what the sample counts but we will not be primarily concerned with this. Numbers by themselves may be meaningless. We will ask that the sample be extracted by one of the more popular extractions and filtered on a filter paper (to be supplied). Although we are not currently attempting to check recovery, it might just be that some interesting as well as usable

data will accumulate for future consideration.

2. The analyst will examine the filter paper for insect fragments. Although 30 magnifications is the level used for routine examination, we recommend, if necessary, that higher magnification be used should the analyst be confronted with suspect particles (perhaps even transfer special suspect particles to a slide for examination under the compound scope). This would perhaps occur in only a few fragment situations, nevertheless it does have tremendous training value.

3. The analyst will remove the material that he considers to be of insect origin, and place each fragment found on a filter paper contained in a small plastic plate. Each fragment will be held firmly in place by adding a minute quantity of liquefied glycerine jelly and allowing it to solidify.

4. The small plastic dish with the fragments determined by the analyst and the original plate, presumably free now of insect material, will be shipped to AACC headquarters for coding (if desired) or directly to one of three experienced analysts for review and comment. These individuals are the keys to this work.

5. Upon receipt, the "reviewer" will first check the original filter paper to determine if any insect fragments remain — apparently unnoticed or foreign to the analyst. If fragments do remain, the reviewer will transfer them to the small plastic dish and any comments of a general nature or about specific fragments will be noted. Second, the fragments determined by the analyst as "insect" will also be checked by the reviewer. If these are satisfactory or if false positives are present, an appropriate comment will be made. As the situation dictates, there may or may not be a brief discussion on specific fragments.

You are perhaps wondering about the work load involved. There is work; the program is ambitious. There will of course be special steps taken to keep the flour or corn meal sample which you will receive at a very convenient counting level. This is good for the analyst and especially so for the "reviewer".

We hope that after experience with the "personalized samples," we will begin to see clear evidence in the direction of uniformity. We want to emphasize that we will not be dealing with a comparison of numbers of fragments, but of specific reasons why fragments are called what they are. It is *the reason why* that will be the main order of business.

Even though we are relying on only a small group setting the "standards" in a sense, there will always be room for honest differences of opinion. For the most part, these honest differences in opinion are not the basic problems in insect fragment work. They will not upset the ultimate goal — *uniformity*. When differences do occur, we feel they can be readily resolved by having based sanitation analyses on a systematic, scientific approach and by discussing points between analyst and reviewer. One more comment about the reviewers. Your papers are not simply being exchanged. They are being sent to individuals who the Committee feels can discuss the whys and wherefores of insect debris in sound scientific terms, terms that will make more and more sense as the samples roll by.

Register Now

With the type of program outline above, the committee will be forced to limit the number of participants. You are therefore urged to register immediately by mailing the registration form printed below (or a copy) together with your check to the address indicated. Make all checks payable to the American Association of Cereal Chemists. The cost is nominal, only $35 for AACC members; $50 for non-AACC members. Remember, this fee includes four samples with a review of each sample to be made by an expert analyst.

Members of the Sanitation Methods Committee of the AACC are: Harvie Barnard, Ross Cory, Donald Dubois, Warren O. Edmonds, Harold Goossens, Robert Kilborn, Paul Marek, John McClure, Thomas McCormack, O'Dean L. Kurtz, *Chairman*.

TO: American Association of Cereal Chemists
1955 University Ave.
St. Paul 4, Minnesota
Attn. Sanitation Analysis

Please enroll me in the AACC's 1960 Insect Fragment Training Series. I understand the first sample will be sent out in January, with additional samples quarterly. I am, am not (circle one) an AACC member. My check is enclosed in the amount of $_____
(Fee: $35 members; $50 nonmembers.)

NAME_____
(Please print or type)

ADDRESS_____
(Address to which samples are to be mailed)

EMPLOYED BY_____

All necessary forms and instructions will be sent with the first sample. Please indicate (1) if you want your samples to be coded; and (2) the type of sample desired.

IMPORTANT! CHECK ONE

Series to be coded_____; Not coded _____.

Sample to be flour_____; Sample to be corn meal_____.

WE LAG IN CORRECTIVE ACTION AGAINST

Food Contamination by Rodents and Birds

By W. W. DYKSTRA, Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C.*

THE PRESENCE OF rodent hair fragments in human food is usually regarded as direct evidence that the product does not meet present-day sanitation standards. When such contamination is discovered, corrective action ends with condemnation of the product. The resultant loss is then charged off as a business expense. In some cases there is a flurry of clean-up activity in the plant concerned, but this eventually subsides and the plant employees fall back into their usual routine of performing daily tasks. Sooner or later another shipment is found to contain rodent filth, and the cycle is repeated.

When contamination of this nature occurs, it should be regarded as evidence of a weakness in the food-processing chain. Proper corrective action goes far beyond intercepting filth in a food product. This is only the beginning. Determining the point at which the contamination occurred and implementing corrective measures to prevent future introduction of foreign material at this location are important features of a sound food sanitation program.

That rodent and bird contamination of food products does not always originate in the processing plant has long been recognized by food and drug inspectors. Extensive surveys of wheat and corn products, in particular, have shown conclusively that only a small percentage of such contamination originates at the mill level. In the vast majority of cases, the rodent hair fragment which you observe under your microscope came into the plant along with one or more of the raw materials going into the finished product.

* Presented at the 44th annual meeting, Washington, D. C., May 1959.

Journey of a Hair Fragment

When that particular rodent hair fragment was on the body of a rat or mouse, it was associated with several hundred thousand other hairs and performed its normal function of keeping the animal warm. From this point it started its long journey. After being shed, it may have been picked up by air currents and carried as much as a mile or more before coming to rest on the surface of a pile of grain. More likely, it was plucked from the animal's body when the rat or mouse cleaned itself. Here it was ingested; it passed through the digestive tract, and wound up in a rodent dropping along with several hundred other hair fragments. Since rodents live on, in, or near food material, the chances are pretty good that the dropping itself became associated with grain. After drying out it was pulverized during some stage in the grain-handling operation. The hair fragment was thus released to come in direct contact with the grain and remain as visual evidence of what had occurred.

The rodent in question lived at some point on the route along which the raw food commodity traveled. Starting with the food plant itself, let us examine the rodent infestation picture at each of several points. The critical area in mills is usually associated with unloading areas adjacent to railroad sidings. These are the points at which rats and mice generally gain entry to the plant. Once the animal is inside, the location of the infestation is dependent upon food and harborage sites. Generally, shelter for rats is provided in the basement portion of the building. Mice, being somewhat more adaptable, often can find all of their living requirements on almost any floor of the structure. Contamination is almost inevitable if rats and mice live within the plant. Hence, rodent-proofing is an important essential of all food plant construction.

Sources of Rodent Contamination

Contamination originating in the railroad boxcar probably occurs much more frequently than is realized. This is evidenced in the findings from a study carried out by W. H. Schoenherr several years ago, in which floor sweepings from 19,276 railroad cars revealed the presence of rodent droppings in 51.7% of the samples. While many of the hair fragments and other filth found at this point are probably brought in along with the material to be shipped, a large portion apparently originates from mice which live between the double walls of the car. At certain seasons of the year, particularly the late fall and early winter months, infestations of this nature are quite common, especially in old wooden railway cars. Some of the mice may spend their entire lifetime within the railroad car, whereas others merely utilize it as a temporary home enroute to a new location.

Up to a few years ago the country elevator was a major contributor to rodent filth in cereal grains. As a result of the grain sanitation program, many of these structures have been cleaned up and contamination at this point has thus been materially reduced. An extreme case illustrating the situation not many years ago involved a country elevator in which over 4,000 dead rats were picked up following a poisoning operation. Shortly after initiation of the grain sanitation program, surveys of country elevators indicated that 76% had rats and 88% were infested with

mice. While vast improvements have been made, rodent infestations are still an ever-present problem in nearly all country elevators.

The most serious point of rodent and bird contamination is generally the bin site — both farm and government storage structures. While considerable effort has been devoted to an educational program directed toward improvement and clean-up of farm bin sites, little real progress has yet been made. The magnitude of this task is illustrated by the findings from one Midwest survey made several years ago, which revealed rodent infestations present in about three-fourths of the storage structures examined.

With the advent of the combine, a minor source of contamination has mushroomed into a major one. This is rodent filth which originates at the time of harvest. When grain is cut, windrowed, and allowed to dry several days prior to combining, it attracts both birds and field mice. The likelihood of contamination at this point was revealed in a study conducted by the University of Minnesota which indicated rodent droppings present in 6.5% of samples taken directly from combines. Contamination in the field may also occur through filth accumulated in machinery during prolonged periods of storage, when the harvesting equipment serves as harborage for rodents.

Individually, no one of the above potential sources of contamination may be particularly significant. However, the accumulation of small amounts of foreign material from each of these points may result in high levels of contamination by the time a product reaches the mill. For example, several years ago samples of corn examined at the mill revealed an average of 298 rodent droppings per bushel. Even though modern cleaning equipment is designed to remove droppings, some of the hair fragments may get by and wind up in the sample examined under your microscope.

One pair of rats living in a granary or warehouse during fall and winter months eats approximately 27 pounds of food. Each rat eliminates about 70 droppings per day. Their 6-months' accumulation is about 25,000 droppings, weighing between 2 and 4 pounds. If you pulverize *one* of the droppings you may find between 100 and 200 hair fragments.

A single pair of house mice living in a granary or warehouse during the same 6-month period eats approximately 4 pounds of food. They each eliminate about 48 droppings per day. These also contain hair fragments which may wind up in the food commodity. Since mice have a limited home range that may not extend more than 10 or 15 feet, many spend their entire lifetime within a small stack of food material. This trait, combined with the likelihood that there are more mice than rats at points along the food channel route, leads us to believe that they constitute a more significant factor in the problem of rodent contamination than do rats.

How Birds Contribute Filth

Field contamination from birds may originate from the droppings of farm fowl, migratory waterfowl, or innumerable forms of songbirds. Bird contamination at other points in the food handling chain is generally associated with either English sparrows or pigeons. Starlings may sometimes be incriminated, but as a rule they utilize the storage structure only as a night-time roosting site, foraging during the day in the surrounding countryside. Being primarily grain eaters, pigeons and sparrows not only find ample food in food-handling establishments, but they also roost at the same location. Hence, they are more likely sources of contamination.

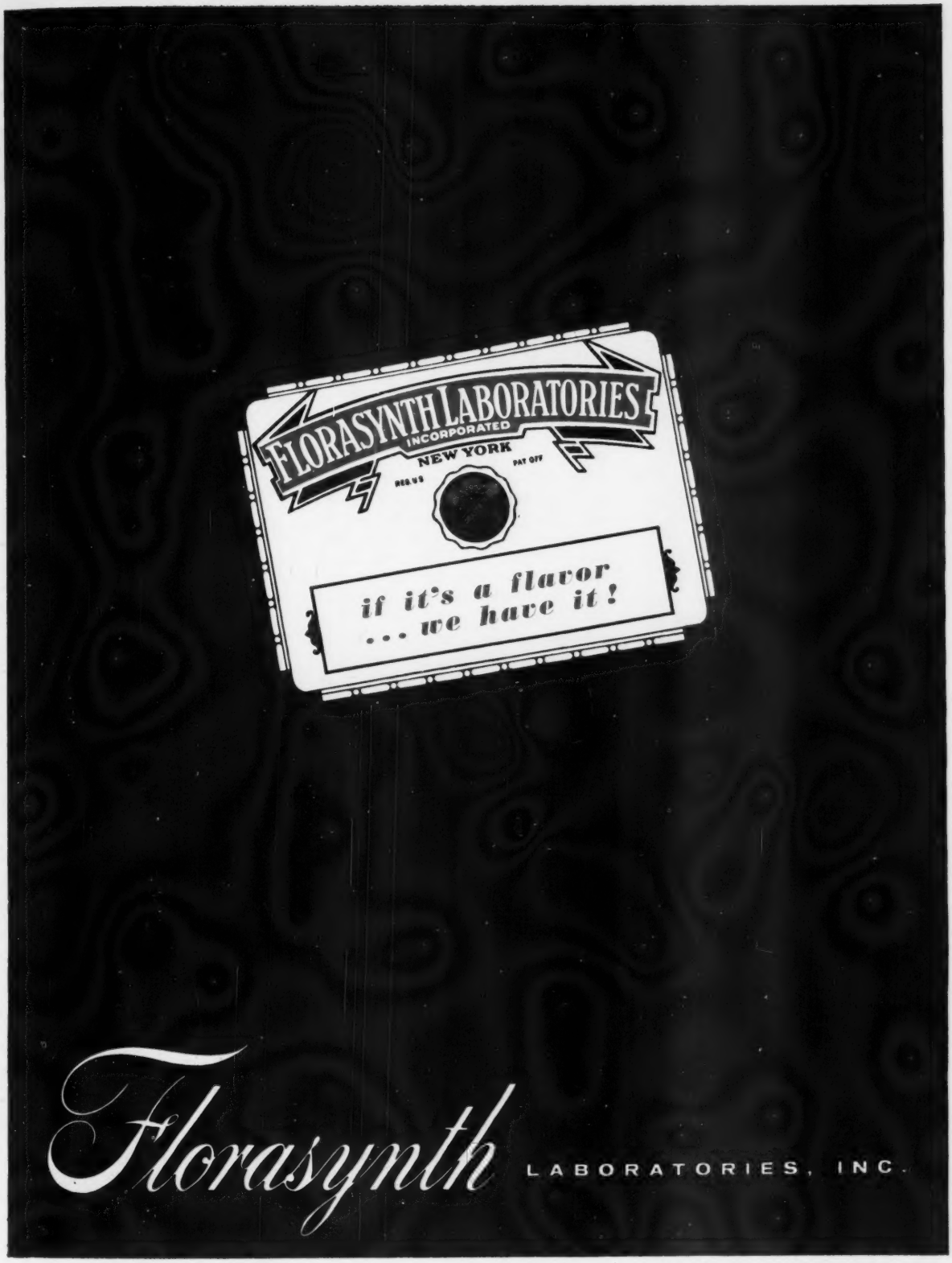
The Situation in Brief

The living organisms which create filth do not respect human likes and dislikes. They are governed by environmental factors such as food, warmth, and shelter. If we are to avoid the undesirable consequences of their presence, we must alter those management practices which provide rodents and birds with these essentials. In the final analysis, *prevention* through careful handling, improved sanitation, and diligent control by both the farmer and food processor is preferable to any other method used to remove filth after it has contaminated grain and other agricultural crops destined for human use.

IMPORTANT NOTICE – 45th ANNUAL MEETING

Members of the AACC wishing to present papers at the 45th Annual Meeting, May 1-5, 1960, in Chicago, should write immediately to the chairman of the session covering their field of interest.

The following sessions have been scheduled: *Cereal Processing*, Harry G. Obermeyer, Central Research Laboratories, General Mills, Inc., 2010 E. Hennepin, Minneapolis 13, Minn.; *Flavor Research*, John Coleman, Central Research, General Foods, Inc., Tarrytown, New York; *Prepared Mixes*, Jim Tucker, Victor Chemical Works, Chicago Heights, Ill.; *Baking and Baking Technology*, Roy C. A. Bradshaw, Quaker Oats Research Laboratories, 617 W. Main St., Barrington, Ill.; *Process Control in the Fermentation Industry*, George J. Fuld, Dept. of Food Technology, M.I.T., Cambridge, Mass.; *General Session*, Eugene F. Garner, QM Food & Container Institute, 1819 W. Pershing Road, Chicago 9; *Feeds and Feed Supplements*, John Mahoney, Chemical Division, Merck and Co., Inc., Rahway, N. J.; *Starch Research*, Thomas J. Schoch, Research Dept., Corn Products Co., Argo, Ill.; *Cellular Concepts in Cereal Research*, Stanley A. Watson, Research Dept., Corn Products Co., Argo, Ill.; *Marketing Research and Statistics*, Howard Bauman, Research Laboratories, The Pillsbury Company, Minneapolis, Minn.; *Cereal Protein Research*, Dale K. Mecham, U.S.D.A., Western Utilization & Development Division, 800 Buchanan Street, Albany 10, Calif.; *Methods and Gadgets Useful in Control*, Donald C. Meek, The Pillsbury Co., Minneapolis 2, Minnesota.



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SALES OFFICES IN PRINCIPAL FOREIGN COUNTRIES

People, Products, Patter

• • • People

Thomas D. Butler joins Merck agricultural products staff as animal health representative in Nebraska and part of Iowa; will work out of Omaha.

Edith Christensen promoted to Head, Testing Section, Standardization and Testing Branch, filling the vacancy created by the retirement of Harry B. Dixon.

Wilbur S. Claus appointed assistant research director of Carnation Laboratories, Los Angeles; has been group leader for Carnation's Albers cereals and Simple Simon frozen foods divisions, and will remain closely associated with these products.

Art Dodds now with Merck & Co., Inc., for the San Francisco area, with headquarters in that city.

James Dugan, Dodge & Olcott Boston sales representative, represented the president of Manhattan College, Brother Augustine Philip, at the inauguration of Asa S. Knowles as president of Northeastern University, Boston, in September.

Eugene Garner moves from Jos. Schlitz Brewing to the Quartermaster Food & Container Institute, Chicago, as chief, Cereal and General Products Branch.

Dick Gartner now with Mrs. Baird's Bakeries, Dallas, Texas, as chemist; formerly of Beardstown Mills Co., Beardstown, Ill. His new laboratory is nearly completed.

Ralph E. Gaylord named to newly created post, director of bakery relations, for Flour Division, General Mills; will work to help solve broad mutual problems affecting both miller and baker. Has been manager of bakery mixes for the Flour Division, and headed institutional products operations of the company since 1954.

Wilbur Hanson now manager of quality control at Chelsea Milling Co., Chelsea, Mich.; from position with F. W. Stock and Sons, Hillsdale, Mich., subsidiary of DCA Food Industries.

Warren D. Roth named a general products sales representative for Merck Chemical Division (SW U.S.), to serve southern California, Arizona, New Mexico, and western Texas; from field sales representative in Idaho, Washington, and Oregon (1951-52) and sales service supervisor in Merck Pacific Coast Branch, Los Angeles, until now.

Louis Sair promoted to technical director, The Griffith Laboratories; will be located at head offices in Chicago. Has been with Griffith in charge of research since 1946; previously, in charge of protein research at Central Soya.

George W. Trum appointed director of baking chemistry department, Union Machinery Div., American Machine & Foundry Co., Richmond, Va.; from Russell-Miller Milling Co., Minneapolis.

Vincent Whalen appointed western regional manager, The Wallerstein Co. (division of Baxter Laboratories, Inc., Staten Island, N.Y.). Continuing his headquarters in Los Angeles, he will be responsible for sales in baking and food products departments, Pacific Coast and Mountain regions.

Joseph F. Zawistowski named sales promotion manager, bakery mix division, The Pillsbury Co.; has been with the company since 1949 in bakery products sales in the Southeast.

• • • Products

Enzymes for ruminants. Feeder interest is growing in the use of "Agrozyme," feed-grade mixture of enzymes produced by Merck & Co., Inc., according to Laurent Michaud, manager of nutrition in animal science research at Merck. Speaking at the 11th Annual Feed and Nutrition Conference, University of Nebraska, Dr. Michaud said that results from several scores of tests now under way are verifying earlier experiments.

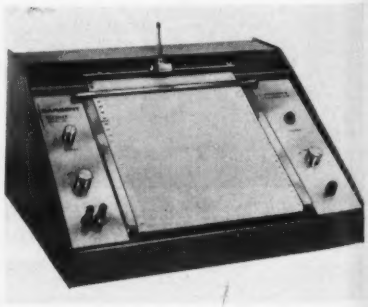
The company is expanding its program of grants-in-aid to state colleges of agriculture, in research with "Agrozyme." Indications are that it can and does improve growth and feed efficiency in cattle, depending on nutritional and management programs; it is effective with corn, milo, or barley; presence or absence of hormones in the ration is immaterial; cattle in pasture, very young calves, and sheep are benefited; stimulation of appetite may be a factor; and it may help in preventing so-called overeating effects in cattle.

Earlier research has indicated that enzymes increase the energy available in some varieties of barley by more than 20%, giving a growth response nearly comparable to that from corn, and has shown the following gains (average or estimated): weight, 12%; feed consumption, 4%; feed utilization, 7%; higher margin of profit, $8 per steer.

In summarizing the present status of "Agrozyme" as a feed supplement, Dr. Michaud said it can improve the production of ruminants by accelerating growth and reducing costs.

• • •

Laboratory recorder. The new Model SR Sargent recorder was designed as a low-cost instrument, with maximum accuracy, suitable for such specific duties as: use with gas chromatogram installations; incorporation in titration assemblies; continuous single-variable recording from an installed transducer; specialized electrolytic operations in analytical laboratories. The specific-purpose user will find in it the electrical and



dynamic characteristics he needs, at low cost for the minimum required flexibility. Write for Bulletin SR: E. H. Sargent & Co., 4647 W. Foster Ave., Chicago 30, Ill.

• • •

Dodge & Olcott, Inc., offers its new price catalog (October 1959) of essential oils, aromatic chemicals and specialties, and certified colors. This 36-page booklet is published semiannually; includes short descriptions and uses of various products, as well as addresses and phone number of branch offices. Copies available upon request to Dodge & Olcott, Inc., 180 Varick St., New York 14, N.Y.

• • • **Patter**

Stauffer-Victor Chemical merger. Recently approved by stockholders, the merger of Victor Chemical Works into Stauffer Chemical Co. becomes effective Nov. 1. Victor operations will be continued as the Victor Chemical Division of Stauffer, under the same management. Voting of common stock of both companies was overwhelmingly in favor of the merger.

• • •

Progress report: book on contamination. On the basis of information provided by a survey, it has been arranged that the forthcoming volume on insect identification by O'Dean Kurtz and Kenton L. Harris will be published by the AOAC, as a public service. The title is: "Identification of insect contamination of food by the micromorphology of insect fragments"; it is anticipated that prepublication orders can be accepted beginning about March, 1960. Further information as to availability and cost will be forthcoming as soon as these matters have been determined.

• • •

Translation available. The office of Technical Services, U.S. Department of Commerce, advises that the following translation is available from Associated Technical Services, Inc., P.O. Box 271, East Orange, N.J.:

"Changes in the properties of flour caused by air classification" (1959), 7 pp.; by E. Hanssen and E. G. Niemann. From **Trans. Intern. Bread Congr., Hamburg, 1955,** pp. 154-157; ATS-83L28b; price, $8.70.

• • •

Quality control investigations. A workshop on a new quality-control technique aimed to cut plant production cost was held October 12-15, in two 2-day sessions, at Monsanto Chemical Co.'s Inorganic Research Laboratory, St. Louis. The method is called "Evolutionary operation" (EVOP). During operation of a chemical plant for normal production, small, controlled changes are made (within the accepted tolerances) in operating conditions such as temperature or pressure, to obtain information that might decrease cost, raise quality, and/or increase production capacity. Statistical translation then indicates how production can be improved. EVOP does not require the skill of a professional statistician but may be applied by operating personnel.

The workshop was sponsored by Monsanto and St. Louis Section of the American Society for Quality Control. Harry O. Hehner, manager of QC for Monsanto Organic Chemicals, headed the workshop committee, assisted by two other Monsanto personnel, R. C. Manring and W. G. Neil. The statistical technique was developed by G. E. P. Box of London, England.

• • •

New Pillsbury mill in Los Angeles. Construction is to begin shortly by The Pillsbury Co. on a new flour mill with a capacity of 4,000 cwt. daily, in the company's complex of elevator, warehouse, refrigerated foods, and offices at East Los Angeles. Production is expected to start next fall.

Meanwhile, obsolescence of the Pillsbury flour mill in Louisville, Ky., may force its closing. A new mill has been budgeted, but further action is awaiting settlement of a suit blocking the company's acquisition of Ballard & Ballard Co. in 1952.

• • •

Dedication of soya plant. The nation's first isolated soya food protein plant was dedicated on October 17 in Chicago by the Central Soya Company, with an open house program including plant tours, a Chicago Waterways tour, and dinner program at the LaSalle Hotel. Speaker at the dinner was Wheeler McMillen, vice-president, Farm Journal, Inc., and chairman of board, The Chemurgic Council.

• • •

Flavor of dentifrices, along with various ingredients and their functions, is discussed in the current issue of "The Givaudan Flavorist," an attractively made-up small bulletin. Another article is entitled "Come with us to Manhattan—A visit to our New York headquarters." Here, words and pictures show how the most modern, elaborate facilities are placed at the disposal of Givaudan flavor chemists and customers. Your copy will be mailed if you request it from Givaudan Flavors, Inc., 321 W. 44th St., New York 36, N. Y.

• • •

Pillsbury dividends. The Board of Directors of The Pillsbury Company recently announced quarterly dividends of 35 cents per share on common stock, payable December 1, 1959, and $1.00 per share on preferred stock, payable January 15, 1960. Shares outstanding are 2,094,720 common and 40,919 preferred. The 35-cent common stock dividend is Pillsbury's 130th consecutive quarterly dividend.

• • •

Vitamin chemists' meetings. The 1959–60 season of the Association of Vitamin Chemists has begun with two meetings so far: in October, a review of the role of antioxidants in animal feeds, given by Richard Gordon of Monsanto Chemical Co.; and in November, studies on the epidemiology and prevention of atherosclerotic heart disease, by J. Stamler of the Heart Control Center, Chicago Board of Health. Meetings to come will present these subjects and speakers: December 3, metabolism and function of vitamin A, by George Wolf, Univ. of Ill.; January 21, energy value of fats, O. Wilder, American Meat Institute Foundation; February 11, protein and amino acid requirements of swine, D. E. Becker, Univ. of Ill.; March 10, recent developments in poultry nutrition, P. E. Waibel, Univ. of Minn.; and May 12, protein and amino acid supplementation, Richard J. Block, Boyce Thompson Institute.

The monthly meetings of the Association are open to the public. They are held at the Illini Union Bldg., 717 S. Wood St. in Chicago, at 7:30 p.m. A dinner precedes each meeting; reservations are handled by George Webster, Dean, College of Pharmacy, Univ. of Ill.

Information concerning activities of the Association can be obtained from any of the officers: Myer Freed, Dawe's Labs. Inc., pres.; Miss G. A. Eckfeldt, QM Food & Container Inst., v-pres.; H. F. Bernholdt, Swift & Co., sec.; and W. K. Calhoun, American Institute of Baking, treas.

• • •

Conventions coming up: 1960. "ASBC convention plans start for the City of Lakes"—Minneapolis,

Minnesota, May 8–12, at the Leamington Hotel, as announced in the **Brewing Chemists' News Letter.** Local arrangements chairman Jerome Haggenmiller of Gluek Brewing Co., Minneapolis, has his committee appointments made and plans under consideration for what should prove to be an outstanding convention.

Monsanto plant expansion. Monsanto Chemical Co. has begun construction on a 50% expansion of its production capacity for bisphenol A, an intermediate used in the manufacture of epoxy, polycarbonate, and oil-soluble phenolic resins. This unit, the John F. Queeny plant at St. Louis, was doubled in size only last year. The additional capacity is necessary to keep ahead of the rapidly growing market for epoxy and polycarbonate resins.

Fortmann:

(Continued from page 292)

carbonyl products. The consumer must be given what he wants, and the baker must produce what he can sell. The kind of flavor is not important so long as the bread "tastes like more" and the consumer buys it. In some areas merely pleasant, clean, and appealing flavor and odor are called for; elsewhere, more character is demanded and the nutty-wheaty or oxidized fat flavors are sought.

The American continuous mixing processes produce mild, clean odor and flavor which lend themselves to control in bread. With continued research effort, great forward strides should be made during the coming years.

Literature Cited

1. Baker, J. C., Parker, H. K., and Fortmann, K. L. *Cereal Chem. 30:* 22–30 (1953).

Jones:

(Continued from page 295)

pounds at the beginning of the refining operation.

Another problem arose from the fact that unextracted rice bran has a tendency to become rancid. It was first thought that microorganisms might be the major factor responsible for the difficulty. Studies indicated this kind of spoilage was more frequently caused by the activity of a lipolytic enzyme in the bran. Though enzyme activity can be inhibited by steam treatment of the bran and storage at low moisture content, the most satisfactory method is immediate extraction of the oil. Bran from which the oil has been extracted frequently brings a higher price for feed use because of its better keeping qualities.

Many of the findings are now being applied in the rice oil industry, which has an average production of more than 11 million pounds a year.

Drying Problems

The shift to combine harvesting brought a new set of processing problems, largely because of the necessity for artificial drying, and furnished the incentive for several research projects on the effect of elevated temperatures on the properties and structure of rice grains, especially in relation to time of heating and moisture content.

One such investigation was that on the effects of heat on the viability of rough rice. These experiments demonstrated that drying temperatures commonly used are much lower than the safe maximum temperature, and that rice with a low moisture content will withstand higher temperatures than will that with a high moisture content. The effects of heat-treatment on milling yields were determined on several samples prepared during the last two years of this study, which extended over a period of three crop years. These tests indicated that the heat-treatments used, in some cases as high as 158° F., caused no milling loss. When the moisture content of rice was lowered gradually, temperatures could be raised without increasing damage from checking and cracking during milling.

The hygroscopic equilibria of rough rice were determined at various temperatures and moisture contents to provide needed information for the guidance of processors, in another research study.

Pilot and commercial mill investigations of the effects of milling conditions on yields of whole-grain rice revealed that careful control of temperature and relative humidity could materially increase such yields.

Findings on rice processing and utilization from the establishment of the Southern Division to the present have been reported in some 60 technical papers and public service patents, of which a listing, with abstracts, has just been compiled. This will be published in the near future, and copies will be available on request.

Pilot-scale filtration-extraction equipment for the extraction of oil-bearing plant materials. The process has been adapted to extraction of oil and wax from rice bran. The bran is presoaked in hexane or a similar solvent in the feeder trough (left) before it is fed into the horizontal rotary filter at the right.

A.A.C.C. COMMITTEE TO HOLD WORKSHOP ON

Farinograph Technology

By W. C. Shuey*, Chairman, Farinograph Workshop, Physical Testing Methods Committee, A.A.C.C.

WOULD YOU LIKE to attend an eight-hour school on the theory and use of the farinograph? If you would, then here are the plans being made by the Physical Testing Methods Committee (formerly Farinograph Standardization Committee).

Background

For the past several years, the committee has been working hard to solve the problem of the variations in farinograms and/or farinograph curves from the same flour. The committee now believes that a major solution to this problem is the standardization and calibration of mixers. These should be available in the near future. However, having a standardized or calibrated mixing bowl is not the whole answer. Improper operating technique or an instrument (excluding mixer) out of order will also give erratic results and lack of corroboration with other laboratories.

Frequently, the problem is one of faulty equipment, careless technique, or an erroneous concept of farinography theory. The school will cover the functions of the instrument, theory and operating practice.

Plans

The workshop will start immediately at the close of the Annual Meeting of the AACC next May. The dates and location are May 5-6 at the American Institute of Baking, Chicago. To refresh your memory on the AACC's 45th Annual Meeting in Chicago, it starts Sunday, May 1, and continues through the early afternoon of Thursday, May 5. About three or three-thirty on the afternoon of May 5, the Farinograph Workshop will begin at the AIB.

Workshop Outline

The *first session* will last about two hours and cover the nomenclature associated with the instrument, the parts of the farinograph, the function of each part, and hints on locating mechanical difficulties. A stripped-down model will be available for demonstration.

The *second session* will begin after a dinner recess. The topic of this session will be the rheological properties of the farinograph. This is the theory period and will last approximately one hour.

The *third session* continues immediately after the second and will be devoted to a discussion of farinograph curve characteristics and the influence of various wheat and flour types. This session should last an hour, at the end of which the workshop will recess until Friday morning, May 6.

The *fourth session* on Friday morning will cover factors affecting farinograph curve characteristics (other than variations in wheat and flour) such as additives by the baker and miller and variations in the operation of the instrument. A one hour session.

The *fifth and last session* will describe techniques; slow speed vs. fast speed; damper settings; constant dough weight vs. constant flour weight (14% moisture) vs. 300 g. flour; how to clean mixer, etc. During this period, each participant will have an opportunity to run a farinograph curve under the supervision of an instructor. This final session should last about two to three hours.

The workshop has been scheduled to end around noon on May 6. This will enable all participants to meet early afternoon check-out hours.

At the beginning of the workshop, each participant will be given a study aid now in preparation by the workshop instructors. This booklet will consist of some fifty or more pages (with illustrations) describing the construction and operation of the farinograph and covering in detail the material of the course. The registration fee is $15 for AACC members, $25 for non-AACC members.

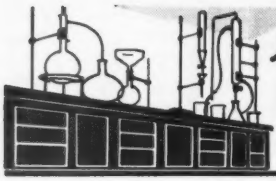
Register Now

Advance registration is now open and will remain open until February 15. The procedure for registration is as follows:

1. Type or print your name and address on a slip of paper and indicate whether or not you are an AACC member.
2. Make out a check payable to the American Association of Cereal Chemists for the amount of the registration fee ($15, AACC members; $25, non-AACC members).
3. Mail your name and address and check to: American Association of Cereal Chemists, 1955 University Ave., St. Paul 4, Minnesota. Attn. Farinograph Workshop.

Remember, advance registration closes February 15, 1960.

* Products Control Laboratory, General Mills, Inc., 1081 - 21st Ave. S.E., Minneapolis 14, Minn.



laboratory HELPS and GADGETS

THE KJELDAHL TEST

Claude Neill of the Enid Board of Trade Laboratory, Enid, Okla., passes on these laboratory helps to CST readers. He says he has picked up many of the ideas from visits in other labs and has found them very helpful in the large cereal testing laboratory of which he is chemist and manager.

"In running the Kjeldahl test for crude protein, many laboratories are now using Kel-Paks No. 1 with pumice stone already added to the polyethylene packet. These plastic packets are readily transferred to the flask; they save time, and they are safer from a health standpoint and will give more accurate results than the use of 10 g. of potassium sulfate and metallic mercury. It is very important that 25 ml., not 20 ml., of sulfuric acid be added to the flask when using these packets; the lower amount will cause results to be low.

"The use of liquid sodium hydroxide or caustic soda in a 50% solution is new in many Midwest laboratories. This can be procured already prepared in large 675-lb. barrels from leading chemical supply houses. To prepare the lye for use at the stills, we add an excess or 7% of Hypo in crystalline form, or 48 lb. direct to the barrel of caustic soda. It should be stirred immediately; we use a narrow paddle, welded on a gas pipe for a handle. The next day we stir thoroughly again. We use a water vacuum aspirator pump with polyethylene tubing, through a rubber stopper to fit our 5-gal. bottles, and pump over this solution from the barrel when needed.

"The use of vacuum pump systems to move sulfuric acid and liquid lye to dispensing burets is an aid to efficiency and safety. In the last few years, most progressive laboratories are using polyethylene tubing in various sizes to transmit acid and alkaline solutions to burets.

"A new though rather expensive innovation is replacement of the glass stopcock plug of the concentrated sulfuric acid buret with a solid Teflon stopcock plug (cost, $12.50). This has been in use in our laboratory for 6 months with no need for lubrication, and it works freely every day.

"Another help is the use of two or three selenized Hengar granules to speed up the digestion process. La'e in the day or when a quick result is needed, these granules will save 15 to 20 minutes in the digestion of a wheat sample.

"Another aid in our large protein testing laboratory: 0.5% boric acid solution with indicator, added to a large (5-gal) bottle and used for the receiving bottles under the stills. This is prepared in large 18-liter or 5-gal. bottles a few days ahead, and is particularly helpful during the busy harvest season. This boric solution (about 50–60 ml.) is quickly added to the receiving bottles in a box unit containing 12 or 18 bottles. The bottles are placed under the stills every morning and when needed throughout the day. This frees an experienced technician from adding a precise amount of normal solution to each receiving bottle.

"We use cold well-water and automatic thermostats for our protein stills and evaporative coolers for this room. On the hottest summer days the temperature of the solution in the receiving bottles, under the stills, has never exceeded 82°F. This is well under the safe margin of 104°F. for the ammonia in the receiving bottles.

"From Don Abbott, cereal chemist of Oklahoma State University, Stillwater, we are indebted for a new and improved indicator for protein testing at the titrating table. It is a mixed indicator of 0.5 g. of methylene blue and 0.75 g. of methyl red dissolved in 300 ml. of ethyl alcohol. We use 25 ml. of this in a premixed 18-liter bottle of 0.5% boric acid solution. This gives a quick and distinct end-point from green to gray, and then one more drop of 0.1253*N* acid will change it to a purple color. The methyl red will give the titrator a color warning when approaching the neutral point, and the methylene blue apparently helps to give a precise color change with the final drop of the solution from the buret. This indicator holds its color well if used within a month.

"I would recommend the use of 0.1253*N* acid and alkali solutions to permit direct estimation of protein content from the titration value. We do not use any figures in the second place of our reported results other than 0 and 5; eg., 13.60% and 13.65%. The use of this direct reading of the buret eliminates the need of looking for a conversion chart on the wall or the titration table.

"Our solutions are checked with 0.10 g. of ammonium oxalate digested with a cube of sugar, and are run completely through the Kjeldahl system. Also we use a standard 0.1253*N* sodium hydroxide and sulfuric acid solution purchased from a large chemical supply house.

"Constant watchfulness and care in grinding the wheat samples and weighing of all samples, together with expert care with the digestion and distillation processes are needed to produce uniform and accurate protein results."

• • • •

AUTOMATIC FEED FOR LARGE-VOLUME FILTRATIONS

When a large volume of liquid is to be filtered, it will be found convenient to place it in a volumetric flask and then suspend it in an inverted position over the funnel, with the neck of the flask below the level of the filter paper.

Feed will be completely automatic, as the solution cannot run out of the flask until the liquid level in the funnel drops below the neck of the volumetric flask.

A variation of the above scheme is to use for the reservoir a vial-mouth bottle closed with a stopper having a piece of large-diameter glass tubing through it. This will allow uninterrupted filtration of as much as 5 gal. of liquid at a time without attention from the technician.

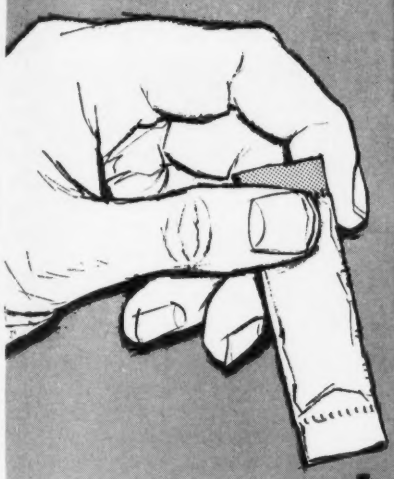
• • • •

SOURCE OF ERROR IN "AUTOMATIC ZERO" BURETS

When an "Automatic Zero" buret is filled, quite often nearly a whole drop of solution may cling to the tip which forms the zero point. When solution is drawn from the buret this drop will be sucked back in, causing an error of almost 0.05 ml.

It is suggested that when running blanks, calibrating a buret, or at any other time when really precise measurements are required, the technician should make sure that no surplus solution has accumulated at the zero point.

Ross Cory

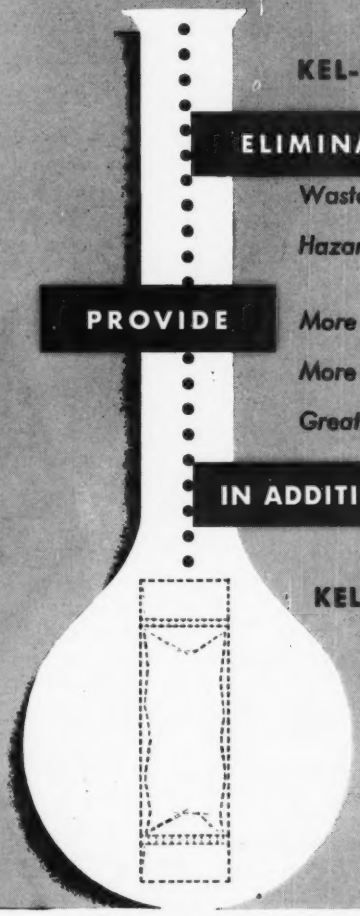


FOR YOUR CONVENIENCE

Harshaw KEL-PAK Digestion Catalyst Powders

Harshaw KEL-PAK Powders are carefully compounded mixtures of Potassium Sulphate; Mercuric Oxide and/or Copper Sulphate in sealed polyethylene packets containing sufficient catalyst for one protein determination.

To use, simply drop one packet into flask



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ELIMINATE *Messy mixing operations*

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Hazardous handling of mercury or its compounds

PROVIDE *More uniform mixtures*

More accurate additions

Greater speed in adding catalyst to flask

IN ADDITION.. *Polyethylene packet reduces foaming*

KEL-PAK POWDERS are available in 5 formulas

#1 9.9 grams K_2SO_4; .41 gram H_gO; .08 $CuSO_4$
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#3 9 grams K_2SO_4; .35 gram H_gO*
#4 10 grams K_2SO_4; .7 gram H_gO*
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AACC

LOCAL SECTIONS

Northwest Section had two October meetings, at Jax Cafe, Minneapolis. On the 2nd, President D. B. Pratt was present to greet members and to promote the theme of better communication between control people and management, to the end that salaries and company recognition may be improved.

On the 30th, Anita Menger of the German Federal Research Institute of Cereal Industry described the work of the Institute. She outlined its functions, and gave some details about particular studies and projects and how they are handled there. Current problems were touched upon also.

• • • •

Midwest Section, meeting on November 2, heard Roy L. Whistler of Purdue University speak on carbohydrate research at Purdue, and on starch and starch granules according to recent findings.

During business session at the October meeting, Chairman Feigon relayed requests for help on committees for the national convention in 1960. Another need is for sponsors for ladies' breakfasts; the section voted to sponsor one of these.

Two foreign visitors were present in October; Wolfgang Kempf of Germany, and Ron Francis, here from Australia.

Several new members have joined the section: Albert J. Leo, National Pectin Products; Mary Margaret Lally, Inst. American Poultry Industries; Wm. Schlossberg, American Sugar Refining Co.; J. L. Slais, Intl. Flavors and Fragrances; Melvin Potochnick, Jos. Schlitz Brewery Co.; Harold N. Haney, Nat'l Dairy Products Co.; Louis A. Wollermann, Blue Seal Food Products, Inc.; Paul Tack, Jewel Tea Co.; Virginia Grey, Eileen Maywald, and F. E. Kite, all of Corn Products Co.; and Milton P. Baldauf, Quaker Oats Co.

• • • •

New York Section met on October 13 at the Brass Rail Restaurant. Hartley W. Howard of the Borden Company's research division discussed "Protein and amino acid supplementation of flour and bread," illustrating with slides. He said that amino acid-to-protein ratios required for maintaining good growth have been accurately determined in many studies, and form the basis for amino acid supplementation. Just as a chain is only as strong as its weakest link, a protein is only as complete as its lowest ratio of amino acid content to amino acid requirements. Dr. Howard used mathematical equations to show how supplementation can be easily and effectively calculated. A question-and-answer period followed the talk.

At the November meeting on the 10th, Henry Brenner, president of Home Testing Institute, Inc., Port Washington, N.Y., spoke on "Methods of evaluating the consumer acceptance of cereal products."

• • • •

Chesapeake Section's September meeting was held on the 24th at the Oriole Tower Restaurant. The speaker, L. P. Reitz, head of Wheat Section, Cereal Crops, USDA, dealt with "The many faces of wheat improvement" — the improvement of wheat from breeding to breadmaking, involving hybridization, selection, testing, and the distribution of new varieties. He illustrated the talk with an excellent set of slides, one group showing the intricate steps involved in transferring the pollen of one variety to the stigma of another, to establish a new variety.

The October meeting (22nd) was held at Log Lodge, Beltsville; H. I. Janovsky, of Fritzsche Bros., New York City, talked about flavors. He asked his audience to imagine what a world this would be if devoid of flavors. Then he explained the part which the taste buds on our tongues play in detecting flavor, and the way flavors can be enhanced, with traces of salt, for instance. Among other subjects, he outlined the history of the vanilla bean and showed slides describing its processing.

A new type of membership has been voted into the by-laws, namely, an associate membership which costs half the sectional, and grants no voting rights but permits those members to make suggestions about local matters.

Tentative plans for a Christmas party were allowed to wait until the November meeting, the 19th, to be held at the Oriole Tower.

• • • •

Cincinnati Section's committee on wheat drying, headed by Harry Loving, has delayed its work for the time being. Collaborative work of the Cookie Committee will continue, with samples submitted every 3 months.

New members are Bill Finley, Swanson's Cookie Co., Battle Creek, Mich.; and Vince Vogt, Laboratories Div., Kroger Food Foundation, Cincinnati.

Tentatively, the next meeting will be held January 23, 1960, in Columbus, Ohio.

• • • •

Lone Star Section has elected the following officers for 1960: chairman, Donald W. Hatch, Campbell-Taggart Research Corp., Dallas; v-chairman, Donald C. Abbott, Oklahoma State Univ., Stillwater; sec-treas., George Tate, American Foods Inc., Dallas.

New members: Hugh J. Fett, American Foods Inc., and Alfred Horst, Buhler Mill & Engineering Co., Denton, Texas.

• • • •

Niagara Frontier Section held its November dinner meeting on the 9th, at Erie County Technical Institute. Speaker was R. A. Rasmussen, vice-president and director of research, Animal Division, Peter Hand Foundation, Chicago; his subject, "Recent studies to more profitable and shorter feeding schedules in production of ruminant animals." This was discussed from the standpoint of recent findings with beef cattle and sheep, and of chemical findings that will aid in practical application.

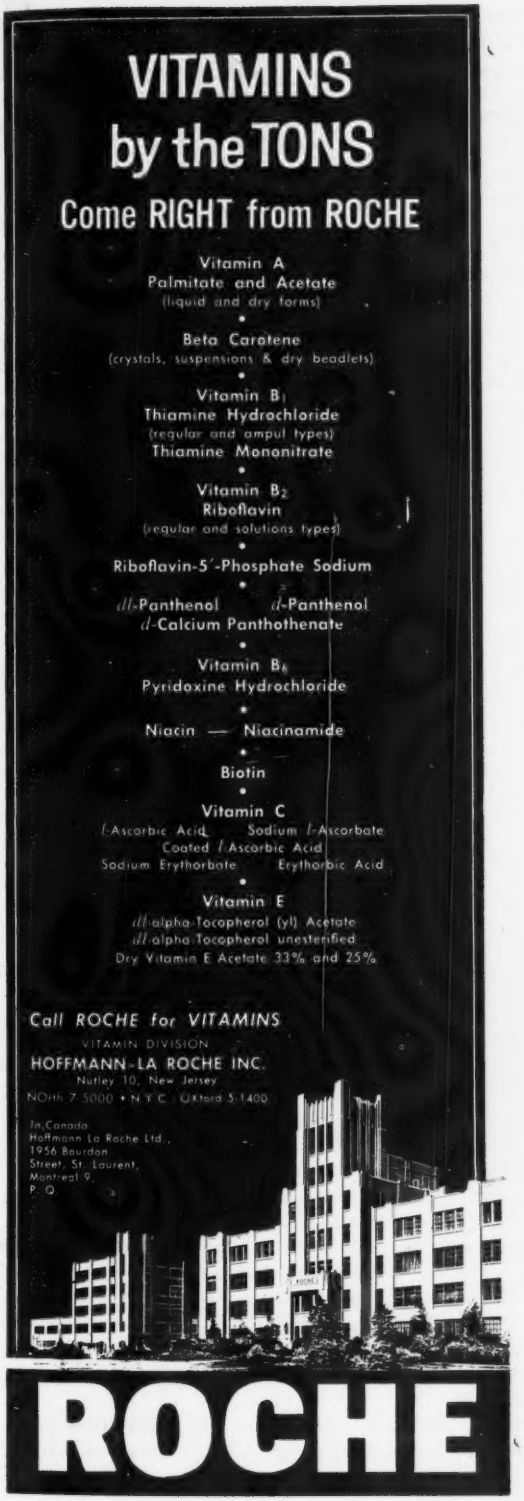
• • • •

Northern California Section met at Henry's Fashion Restaurant in San Francisco, on October 21. Eugene Gwozdz, an exchange student from France and a graduate of the University of Wisconsin, spoke on "Milk and dairy products as related to the baking industry." Mr. Gwozdz is with Western Dairy Products Co. in Petaluma.

For the Section's annual Birthday Party and Ladies' Night on November 12, the entire third floor at Sun Hung Heung was in use for members and guests to enjoy seven exotic dishes of the finest quality Chinese food from one of San Francisco's finest Chinese restaurants, prepared by world-famous chefs.

• • • •

Canadian Prairie Section held a joint conference with its sister section of the AOM in Winnipeg, Nov.



13 and 14, at the Royal Alexandra Hotel. Sessions were separate on the first day, and combined the second day. The program included scientific and technical papers by well-known cereal chemists, millers, and others from Ottawa, Western Canada, and Minneapolis. As a sampling: K. L. Nordstrom, General Mills, Minneapolis, spoke on "Comparison of pneumatic mills with conventional mills regarding the effect on mill stocks"; H. R. Sallans, Prairie Regional Laboratories, Saskatoon, on "Separation of starch and gluten using alkaline dispersants"; A. G. McCalla, Dean Graduate Studies, University of Alberta, on "the macro and molecular structure of gluten"; J. A. Anderson, Grain Research Laboratory, on "Development of new wheat varieties"; and G. N. Irvine, also of the GRL, on "Effect of long storage on flour quality."

• • • •

Toronto Section, Niagara Frontier Section, and Niagara District, AOM, were combined in their ninth annual Trans-Border meeting in another Canadian city – Montreal – on October 23 and 24. The program began with visits to outstanding flour mills – the St. Lawrence, Robin Hood, New Royal, and Ogilvie; then Saturday's program, after the preliminaries, opened with a general discussion of the mill visits, steered by C. P. Dowd of Robin Hood and T. C. Mills of Ogilvie. Papers presented, before and after the luncheon banquet, were: "Use of phosphates in the food industries" by Robert Bryant, Victor Chemical, Chicago; "Wheat slicing – something new in flour milling" by L. C. Palyi, Universal Machine Co. Ltd.; and "Food faddism" by Corinne Trerise, Bakery Foods Foundation of Canada. The program concluded with a panel discussion on "Scientific and chemical controls in the flour milling industry," with R. Kirkwood, Ogilvie Flour Mills, as moderator.

Ladies were given a sightseeing tour of Montreal, and all members and guests enjoyed "Hospitality Evening" on Friday, courtesy of Allied Trades.

the President's Corner

news of the association

September and October were busy months. Fitting the travel schedule for Sectional meetings into business travel allowed me to meet with the Lone Star Section, the Chicago Section, and the Northwest Section at Minneapolis, as well as the Tri-Section meeting held in Manhattan, Kansas.

The Lone Star Section held an excellent 2-day meeting jointly with the Operative Millers at Lake Texhoma. George Schiller, chairman, had done an excellent job of arranging both facilities and the program. It was good

to see many old friends with whom I first started in the field of cereal chemistry. Among these were Fred Patterson, Glen Findley, Charlie Newell, and Ted Warren. It was also good to visit with people from the allied groups, who did much to contribute to the success of the joint meeting. Glenn Fite of Victor Chemical Works presented "The RSVP story of self-rising flours," and Alfred Horst showed a very interesting film produced by the Buhler Mill Engineering Co. Reuben Kachikian of Chas. Pfizer & Co. talked on "New horizons in the food and baking industry," a very interesting talk. Dick Gartner, who has just established the baking laboratory for Mrs. Baird's Bakeries, presented the film, "Our daily bread," which was extremely interesting.

Here in Minneapolis at the Northwest Section meeting it was good to see some of the old timers who have retired in the past year, in attendance at the first fall meeting. Fred Collatz and Doc Harrell were renewing old acquaintances and getting caught up on all the current gossip.

In Chicago, despite the World Series, about 80 members of the Midwest Section turned out, although we couldn't get the meeting started until the game was over. Ed Feigon, Bob Koch, Freeman Machon, and Bill Bradley are doing an excellent job of arranging the coming annual meeting in May, and we'll be hearing much more from them in the next few months. The Midwest Section continues to grow and prosper, and many new faces are in evidence there. National Dairy Products has established a research laboratory and it was good to see Harold Haney, who now works for this company. The loyalty of the Chicago group is outstanding. Many members have been regulars for as long as 30 years, and many old friends were in attendance whom I knew when I was in Chicago many years ago — Charlie O'Malley, Carl Obenauf, Hi Spannuth, Welker Bechtel, and Charlie McWilliams, to name a few.

The Tri-Section meeting held in Manhattan on Oct. 9 and 10 was an excellent meeting, attended by well over a hundred chemists. At the Friday evening meeting E. E. Jarnagin and Phillip Talbott gave a very interesting presentation on the role of the cereal chemist and baker in planning for continuity of cereal production in the event of a nuclear attack. This was an interesting and very thought-provoking subject for cereal chemists to consider. Saturday morning at the K-State campus a full program on wheat variety development was presented by the KSU staff. E. G. Heyne, C. O. Johnstone, R. H. Painter, and J. A. Shellenberger took part in this symposium, which presented the various problems confronting the development of new wheat varieties. The allied trades group again made the social portion of the program prior to the smorgasbord on Friday evening a very pleasant one, affording everyone an opportunity to visit with old friends and to make new ones.

Within each Section which I have visited so far, it is gratifying to see how active these groups are in maintaining their associations with the AACC and with the allied groups so closely connected to our organization. It's healthy and makes a wonderful impression on the other people just getting started in our chosen field.

More again next month.

D. B. Pratt, Jr.

Report on Annual Meeting of Agricultural Research Institute

The eighth annual meeting of the Agricultural Research Institute was held in Washington, D. C., on October 12th and 13th. Total registration was about 150. Featured on the program were panel discussions on the subjects of soil-crop-water relationships and plant composition in relation to soil nutrients. Outstanding papers on basic research in plant nutrition by S. B. Hendricks of the U.S. Department of Agriculture, and on plant research under controlled environmental conditions by James Bonner of the California Institute of Technology, were also given.

Of particular interest to cereal chemists should be the techniques developed by Dr. Bonner for the accurate control of light and both root and top temperature in experimental crop production. Such techniques could conceivably be used to advantage in grain breeding to select early generations of those strains that would be particularly well adapted to specific environmental conditions. It might be possible, for example, to develop varieties of hard red winter wheat immune or resistant to the type of gluten injury that often occurs as a result of excessively high atmospheric temperatures prior to harvest.

The grain processing industries are not well represented in the membership of A.R.I., and it would seem that a better representation might well lead to a strengthening of research activities in the field of cereal science, which would be of benefit to these industries. Complete information on the objectives, activities, and membership requirements of A.R.I. can be obtained by writing to Dr. LeRoy Voris, Executive Secretary, Agricultural Research Institute, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C.

Lawrence Zeleny

AACC Technical Representative to Agricultural Research Institute

A.A.C.C. ANNOUNCES 1960 MEETING

The American Association of Cereal Chemists will hold its 45th Annual Meeting, May 1-5, 1960, in Chicago at the Morrison Hotel. Robert B. Koch, Quartermaster Food & Container Institute, Chicago, will be Program Chairman. Edward Feigon of Kitchen Art Foods, Chicago, will be in charge of Local Arrangements.

The Technical Sessions will begin Monday afternoon with four 40-minute talks by invited speakers. Tuesday morning the regular technical program gets underway with concurrent sessions scheduled for all day Tuesday and Wednesday. Anyl AACC member wishing to present a paper at the meeting should contact the session chairman immediately (see page 300 for names and addresses).

Open Technical Committee meetings are scheduled for Thursday morning while the AACC's annual meeting will take place Thursday afternoon.

R. J. Tarleton

Executive Secretary

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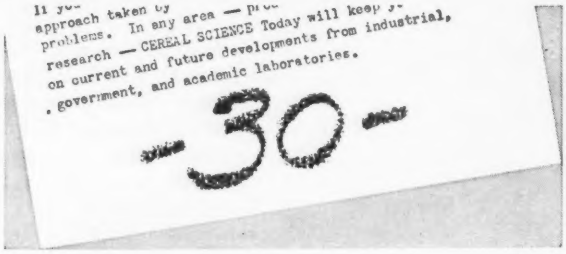
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EUROPE REVISITED

We think you will be interested in these observations made by Dr. Robert A. Larsen of the Pillsbury Co. after several weeks' traveling in Europe and Russia.

• • •

"Perhaps the most striking thing about Europe is the difference between economic conditions today and, for example, as short a time span as two years ago. The existence of the common markets (by this I mean the market of the inner six and the market of the outer seven) has put muscles into European commerce. France has a new vigor. Switzerland looks to the world as her market. The Scandinavian countries are working together as never before. Russia has opened new wheat fields in the East (as Dr. J. A. Anderson from Winnipeg can attest from personal observation). The growing of poultry in huge chicken houses is a reality in Switzerland. Pig farming in Sweden is in many ways far advanced.

There are reasons to believe that the common market philosophy will lead to restrictions on imports of wheat to European countries allowing only domestic wheats to be milled. With the prospect of using only local wheats of soft types for making bread flour, and severe restrictions already operating on the use of maturing and bleaching agents in flour, these problems have led to a resurgence of cereal research overseas. This has been aided by the consolidation of milling interests in the various countries and the resulting rise of organizations large enough to support commercial type research organizations. Research work goes on not only in these companies but also in government institutes, universities and private technical institutes.

One has the impression that Europe has not only recovered from the problems caused by the last war but is ready to break through an economic barrier to a new and very high standard of living. It is a most heartening prospect.

Dr. N. P. Kosmina, head of the All-Soviet Union Institute for Cereal Research in Moscow, sent with me her greetings to her many technical friends in the United States and in Europe. While there, I visited not only with Kosmina but Peter Volansky — head milling engineer of Kosmina's Institute, Dr. I. Isikovich — the man in charge of the Soviet Union Milling School, Dr. Sorolov — in charge of milling machinery design and production for the Ministry of Grain, and Dr. I. Maslov of the All-Soviet Union Institute for Bread Baking. These men and their colleagues were interested in the Pillsbury turbo milling research program, and I was equally interested in the milling research that they have done. As scientists we had much to discuss, and we laid the basis for continued discussions by letter. Having seen Russian facilities and met their people, I hope that they soon come to the United States so that we can do the same for them.

I am sure that is going to happen much more with all European scientists. With the advent of jets, it now is only seven hours to cross the ocean. This is the time span of a working day. With the step-up of research activities here and abroad, we have much to talk about to each other. Face to face discussions of this type are bound to be mutually profitable in many ways."

A Very Merry Christmas

and Happy New Year

from all of us at DOTY Laboratories

1435 Clay St.,
North Kansas City 16, Mo.